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The US Response to China's ASAT Test

An International Security Space Alliance for the Future

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Lieutenant Colonel, USAF

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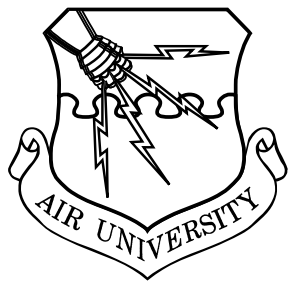

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Foreword

Lt Col Anthony Mastalir has done policy makers a welcome service by exploring the enigma wrapped in a conundrum which is Chinese space policy, focusing on the Chinese kinetic energy antisatellite (KE-ASAT) test of January 2007. That test ended a de facto moratorium on KE-ASAT tests which the United States and Russia had observed for over two decades. It also announced the arrival of a new player in strategic space, forcing a reevaluation of US capabilities in space as well as Chinese intentions there. Colonel Mastalir examines both that reevaluation and those intentions, relying on open-source material, particularly from Chinese strategic and military analysts.

Of chief interest, of course, are the motives of the People's Republic of China (PRC) leadership for demonstrating a technology—kinetic kill of satellites in low-earth orbit—which is so destructive to the common environment of space. This in particular is something PRC spokesmen themselves have never adequately explained. Still, what emerges from the documents the author examines is the picture of an intellectual framework of deterrence strikingly similar to that which the United States developed in the 1950s and thereafter. The fathers of US deterrence strategy—Thomas Schelling, Albert Wohlstetter, and Herman Kahn, among others—would certainly recognize People's Liberation Army (PLA) space strategists as their intellectual heirs. Chinese determination to counter strategic "hegemony" on earth and in space, and the apparent conviction of PLA strategic planners that a robust and demonstrated ASAT capability is necessary to offset what they see as the offensive potential of programs like missile defense, would be instantly recognizable to those US strategists who developed the doctrines of countervalue deterrence, escalation dominance, asymmetric warfare, and assured second-strike capability.

Nor is there anything essentially alien about what the author concludes is China's use of space as a symbol of status in the international community. It is we and the Soviets who made space capability a marker of international prestige, and that tradition continues in the commentaries of those who imagine a reignited race to the Moon and Mars, which the United States must win in order to demonstrate national power and superior-

ity. In short, the Chinese, as they emerge from the public documents the author has relied on, are less inscrutable than we might imagine. On the contrary, they seem to have come to the same conclusions as we that no Great Power can afford not to have a human spaceflight capability, to ignore the military force multiplier effects that space provides, or to discount the possibility of hostilities in space.

These are, of course, the motives of any great national power in any realm of potential strategic competition. The question for policy makers—in space as within the atmosphere—is not how to prevent China's rise, but rather how to protect US interests and avoid conflict as this process unfolds.

This is not the first time the problem of maximizing interests while avoiding hostilities has arisen in the space age. It was the prevailing theme of space policy in the Cold War. Both the United States and the Soviet Union planned for hostilities in space, both developed and tested ASAT systems, and both unilaterally abandoned those systems while the Cold War was still at its height. Indeed, in the face of great international tension and the threat of nuclear war, the relations between the two Great Powers in the Cold War remained characterized by what might be called grudging cooperation. Clay Moltz and others have argued that the absence of overt hostilities in space during the Cold War resulted from the perception on the part of both nations that maintaining their own systems was of greater value than threatening the systems of the other side. Whatever the cause, space was one of the first areas to witness steps toward Cold War détente with Richard Nixon's proposal for a joint Apollo-Soyuz mission in the early 1970s.

The rise of the PRC presents US policy makers with a new strategic challenge. But the circumstances of China's arrival as a space power are—as the author points out—far more propitious than those that reigned during the Cold War. Then, Soviet actions were informed by a permanent ideological hostility to capitalism in general and the United States in particular. Now, ideology is in retreat in both the PRC and the United States. After all, what enables the Chinese to challenge US predominance in space is economic and technological strength based on the principles which US entrepreneurs both recognize and admire. The Soviets were geographically expansionist. The Chi-

nese seem to have little interest in extending their direct control beyond the near abroad, although this includes Taiwan. During the Cold War, a combination of US containment policies and the autarkic impulses of the Soviet leadership insured that the communist world economy would be isolated from the world economy—and therefore doomed. But the PRC leadership has followed precisely the opposite path, with the result that Western and Chinese economies are now codependent. The consequence is mutual dependence on a safe and predictable space environment. The ways and means of creating such an environment are the crux of Colonel Mastalir's study.

He suggests a number of steps, prominent among them the restoration of space cooperation with friends and allies, greater reliance on "soft power," modification of the draconian trade restrictions of the International Traffic in Arms Regulations (ITAR) regime, greater reliance on confidence-building measures, agreed rules of engagement, and joint efforts at debris mitigation. He strongly underlines the need to find some peaceful solution to potential rivalries in space, not least because of the crushing expense that an arms race in space would mean for both China and the United States.

This is not a naïve study. The author recognizes the potential for hostilities in space and recognizes, too, that a movement in that direction may very well result from decisions over which the United States has little control. But equally, he offers a corrective to the view that what we are facing is a determined and unified opponent. We know that our own policy often results from brokerage among competing bureaucratic and congressional and private interests, that those charged with implementing policy can distort or "slow roll" the clearest executive direction, and that ignorance and personal rivalry can and often do influence decisively the policy outcome. But we tend to impute to our potential opponents cold-blooded rationality and singleness of purpose. Colonel Mastalir avoids this illusion, emphasizing instead the bureaucratic disagreements and lack of communication evident in the PRC documents. One might add that PRC foreign office personnel and other Chinese commentators have been quite open in professing their ignorance of the PLA's motives for the ASAT test—so perhaps Chinese policy making is as opaque to many on the inside as it is to us.

If I were to add something to the author's analysis, it would be greater attention to the Chinese space white papers. There have been two of these, one in 2000 and the latest in 2006. They describe a space policy overwhelmingly directed toward economic development and international prestige, with some attention as well to exploiting space for purposes of military modernization. There are those in the West who believe that such policy statements are meant as propaganda to distract the West from secret and more malevolent designs. Perhaps they are, in part. But while we may be ignorant of the inner workings of the Chinese bureaucracy, we know that it is a bureaucracy. We can therefore assume that these white papers—like the policy statements our government issues on space—result from protracted negotiations among various bureaucratic players and represent some common denominator among their competing interests. Moreover, in a bureaucracy as secretive and divided as that of China, we can be reasonably certain that whether or not the white papers are a true statement of Chinese policy, hundreds of thousands of Chinese bureaucrats believe—and behave as if—they are. Perhaps we cannot take at face value what these policy documents say, but neither should they be dismissed as irrelevant.

In short, it is Colonel Mastalir's accomplishment to have shed some welcome light in an area which will be of increasing concern to US policy makers in the years and decades to come. I expect this will become one of the foundational documents which policy makers and academics draw upon to manage China's "peaceful rise" as a space-faring nation.

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About the Author

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Lt Col Anthony J. Mastalir is the commander, 595th Operations Support Squadron, 595th Space Group, Space Innovation and Development Center (SIDC), Schriever AFB, Colorado. The mission of the squadron is to enhance air and space force readiness by providing operations and intelligence support to the test, advanced training, space tactics, and force development missions of the 595th Space Group and the SIDC. He took command 25 June 2006.

Colonel Mastalir entered the Air Force as a distinguished graduate of the Northwestern University Air Force Reserve Officer Training Corps. He is a credentialed space professional, having completed a series of operational assignments in the areas of space control, satellite command and control, and ICBM launch operations. The colonel has held internships on the Pentagon staffs of the deputy chief of staff for Air and Space Operations (AF/XO) and the assistant secretary of defense for legislative affairs (OSD/LA). He has served at Headquarters Air Force Space Command as a space control requirements command lead, speechwriter, and aide-de-camp to the commander. He has also led the SIDC's Integration Division, responsible for the development and integration of innovative space capabilities, the planning and execution of exercises and war games, and the development of space modeling tools and simulated space environments.

He earned a master's degree in organizational management as a fellow at the George Washington University, a master's degree with highest distinction in national security and strategic studies from the Naval War College, and a master's degree in airpower art and science from Air University's School of Advanced Air and Space Studies.

Colonel Mastalir is a command space and missile operator with qualifications in the Defense Satellite Communications System III, Skynet 4, Inertial Upper Stage, Minuteman III, and Deployable Space Support Segment III weapon systems. He is married to the former Danielle Bailey of Atlanta, Georgia. They have two children, a daughter, Mikel, and a son, André.

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I am deeply grateful to the faculty, staff, and students at the School of Advanced Air and Space Studies (SAASS) for their investment of time and energy in pursuit of higher learning. Through seminar discussions, faculty lectures, and casual conversations, my colleagues and professors have deepened my understanding of and appreciation for the art and science of strategy and air and space power.

The opportunity to continue this research has been a tremendously rewarding experience. I would like to thank Amb. Roger G. Harrison, director of the Eisenhower Center for Space and Defense Studies, United States Air Force Academy, for inviting me to participate in the 2008 National Space Forum, where I had the opportunity to dialogue with the nation's leading thinkers on space policy. The addresses, discussions, and interviews with which I was associated significantly shaped this paper. Specifically, I am indebted to the Hon. Peter Teets; Rep. Jane Harmon; Gen Tom Moorman, USAF, retired; Gen C. Robert Kehler, USAF; Lt Gen Michael Hamel, USAF; Dr. Joan Johnson-Freese; Mr. Michael Gold; Ms. Theresa Hitchens; Ms. Marion Blakely; Dr. Joanne Gabrynowicz; Mr. Michael Gass; Ms. Joanne Maguire; Mr. Joseph Rouge; Dr. Simon P. Worden; Dr. Larry Wortzel; and Col Dustin Tyson, USAF. Their specific contributions are noted in the text.

I could not have completed this project without the tireless support and guidance of my research advisor, Dr. John Sheldon, and the other outstanding scholars at the SAASS. Dr. Sheldon always took the time to answer a question, share a perspective, or review a section. His continued encouragement was extraordinary. Additionally, I would like to thank Dr. John Davis, Dr. Andrew Erickson, and Dr. Joan Johnson-Freese, my readers, for their wealth of knowledge and expertise. Their critical reviews and comments have significantly contributed to the balance and depth of the research that follows.

Most importantly, I am indebted to my beautiful wife, Danielle, and my two adorable children, Mikel and André, who routinely demonstrated tremendous patience and understanding during many nights and weekends throughout the course of this paper. I am truly humbled by their unconditional love and commitment.

Chapter 1

Introduction

> *In a manner itself paradoxical, it is those who are materially weaker, and therefore have good reason to fear a straightforward clash of strength against strength, who can most benefit by self-weakening paradoxical conduct—if it obtains the advantage of surprise, which may yet offer victory.*
>
> —Edward N. Luttwak

Nearly three years have passed since China's successful antisatellite (ASAT) test ushered in a new era of space competition. If US civilian and military leaders are any closer to gleaning China's overall strategic intent vis-à-vis the acquisition of space weaponry, it is not readily apparent. Somewhere in the Pentagon finance office sits an impressive stack of international travel vouchers, evidence of the numerous trips US Defense Department representatives have made to Beijing in search of answers. One bears the name of US defense secretary Robert M. Gates, who broached the antisatellite issue with China defense minister Cao Gangchuan during his first official visit to the People's Republic of China (PRC). But Cao was unwilling to even entertain the subject. According to Gates, "With respect to the anti-satellite test, I raised our concerns about it, and there was no further discussion."[1] Ultimately, Gates fared no better at gaining answers than the military commanders who went before him. Since its first successful ASAT test on 11 January 2007, China still offers no answers to one of the most troubling strategic space questions of the twenty-first century. Why is China building space weapons?

The United States, and the rest of the world, must accept that it may be a long time before the answer to this question becomes clear—if that ever happens at all. In the weeks and months following the test, most US leaders shared the sense that something must be done. In light of the debris strewn throughout low-earth orbit, scientists lamented the fact that

the United States chose not to issue a démarche in the days before the test. US diplomatic efforts toward China became increasingly cumbersome on 12 January, and policy makers began to explore opportunities to dissuade or deter a repeat performance. Members of the intelligence community, initially sanguine about their collection achievement, quickly realized that the advent of space warfare will create new and extraordinary collection requirements. Analysts, both internal and external, began to speculate about the intelligence resources necessary to meet those requirements. Military commanders were reeling. Without either the capabilities to protect US space assets from antisatellite attacks or any practical means to preempt an ASAT launch from deep within China's sovereign territory, military options remained limited. Space leaders within the Department of Defense (DOD) immediately called out for new systems with the capabilities commanders need to protect the nation's critical space inventory. Space industry leaders were equally stunned. Space, as a contested environment, completely changed the functional paradigm.

In light of the potential implications of the ASAT test, what is the best solution set for the United States to pursue? The previous administration wanted to know as does, undoubtedly, its successor. Pres. George W. Bush reportedly issued a classified memo to various government agencies in the months following China's ASAT demonstration. The memo directed the State and Defense Departments to form "a cohesive government-wide approach both to avoid future anti-satellite launches and formulate plans on how to deal with them if they occur."[2] The assignment is not an easy task, especially since China's intentions are unclear. Nonetheless, the president's choice of the word *cohesive* and his decision to include the State Department are most appropriate. In his manuscript on grand strategy, Edward Luttwak wrote of the importance of coherence in both the horizontal and vertical dimensions. He argues that military efforts, even if well integrated vertically, will likely fail or become counterproductive if horizontal disharmony exists across, for example, other instruments of national power. Luttwak notes that "there are cases of weapons successful at all military levels but counterproductive at the level of grand strategy because they fail in the horizontal dimension. German pre-1914 battle-

ships were wonderfully advanced and did well in combat, but all they ever gained for Germany was Britain's lethal hostilities . . . a wholly predictable result."[3]

Contextual Basis and Attendant Assumptions

The challenge, therefore, is to assemble a US response that not only addresses the strategic issue posed by an ASAT-armed China but that also achieves both vertical and horizontal harmony. As any strategist quickly learns, before coherent course-of-action analysis can take place, one must identify the leading assumptions necessary to bound the problem. A forensic review of open-source Chinese literature—including the spoken and written words of China's military scholars, strategists, political leaders, and international diplomats—offers keen perceptions regarding the issues upon which internal Chinese policy deliberations focus. Military researchers and academics generally develop People's Liberation Army (PLA) military doctrine, not operators and planners, as is often the case in the US military. PLA publishers produce several hundred books every year.[4] The findings from this research are provided to military educational institutes and to PLA war-fighting commanders.[5] Some of these reports are circulated externally and are available for public consumption. Open-source literature is not a substitute for authoritative sources, and strategists must appreciate its inherent limitations; nonetheless, it provides a reasonable alternative when authoritative sources are unavailable. The forensics, taken as a whole, support the following contextual basis and attendant assumptions.[6]

China's ascendance to regional superpower status is increasingly dependent on the preservation of its freedom of action throughout the global commons. China envisions a multipolar, global security environment in which it exerts significant influence over international policy decisions. Its desire for national prestige and international relevance intensely shapes internal decision-making processes. Space power is perceived to be a key enabler toward the attainment of China's long-term vision.

China is making steady progress toward becoming a major space power. Its unprecedented economic growth has sustained

a military modernization program making rapid advancements in nearly all aspects of warfare, most notably space-based effects. China appears to have the political will, national resources, and technological elements necessary to transform its People's Liberation Army into a modern fighting force capable of "informationized" (or information) warfare. Its national leaders have embraced a revolution in military affairs, with space capabilities at the core, and hope to further China's international prestige by implementing a robust space doctrine.

China's emerging space doctrine is the driving force behind its efforts to develop antisatellite weapons. The PLA, as well as its closely associated research and development academies, perceive a significant advantage in developing the capabilities to conduct space warfare. ASATs represent a relatively simple, cost-effective option to counter what Chinese military leaders describe as an expanding US space hegemony—a perception that pervades Chinese strategy circles. Hegemonic powers in any domain constitute a real threat toward China's long-term vision.

Strategically, China's military planners and strategists believe ASATs are a critical element of a robust space deterrent that can further protect China's nuclear and conventional deterrents against emerging threats like US ballistic missile defense programs. Doctrinally, China places a premium on deterrence strategies and will relentlessly pursue the requisite capabilities to protect it from coercion or blackmail. The antisatellite test communicated, unequivocally, that China has a direct-ascent antisatellite capability and is willing to use it—fulfilling all the criteria for a credible deterrent strategy.

Operationally, PLA commanders are wholly focused on the near-term issues related to Taiwan. Chinese Communist Party (CCP) leaders and the Central Military Commission (CMC) have made the preservation of national integrity, and specifically Taiwanese reunification, one of the PLA's highest priorities. The issue is paramount to China's efforts to establish internal legitimacy and develop as a modern power. Space weaponry represents sovereign options for military leaders should they be called upon to exert Beijing's influence over the "rogue" province. ASATs may be employed to deter or delay US intervention should cross-Strait hostilities intensify and represent an escalatory preemptive attack option against either Taiwan or the

United States if deemed absolutely necessary. The extent to which China will employ all options necessary to preclude Taiwanese independence should not be underestimated.

Ironically, China's successful ASAT strategy appears to have fomented bureaucratic discord. The extent to which space weaponry will facilitate China's burgeoning military modernization effort is still not clear to all the members of China's most influential power base—the Standing Committee. The decision to test a direct-ascent ASAT was debated internally within the CMC years ago; however, strict compartmentalization and a culturally rooted obsession with secrecy precluded the assimilation of a wider range of perspectives. The Foreign Ministry, to include China's delegation at the United Nations (UN) in Geneva and other international organizations, was not among those whose consensus was deemed essential. Consequently, it was not consulted. When the news of the low-earth orbit collision became public, it was quite possibly the most outraged.

Despite China's abysmal interagency coordination process, Hu Jintao, as chairman of the CMC, most assuredly granted approval for the 11 January test, just as he had in each of the preceding years. Unfortunately, he underestimated the international condemnation that resulted for several reasons. First, the space debris issue was successfully marginalized by CMC advisors whose estimates were unopposed by experts most closely attuned to the international rhetoric on the subject. Likewise, the political fallout was not closely scrutinized by those diplomats most familiar with China's efforts at the UN. Finally, the worldwide reaction was predicted to be minimal; earlier tests had provoked no reaction from US officials, whose silence on the issue was likely interpreted as indifference. It is perhaps worth noting that political-military misalignments are inescapable. These are iterative processes, and it is possible that China will "fix" some of these problems. Even if China's interagency process remains largely ineffective, other internal corrective actions may be forthcoming. Nevertheless, in the context provided at the time, Hu's decision to approve the 11 January test without extensive deliberations in the Politburo or Standing Committee appears both reasonable and rational.

Assumption 1: China's stated commitment to a negotiated space treaty is unreliable.

The assertion that China designed its ASAT test to cajole the United States to the negotiating table, while plausible, is not well supported. In 2005, while Chinese diplomats harangued their foreign counterparts in meetings at the UN, senior-level PLA officers convened a task force on military space issues. In concluding that the weaponization of space is inevitable, they argued, "China must prepare itself and should not tie its hands through overly restrictive international legal treaties." In other words, while it is in China's interest to work diplomatically to the extent it can, "it should not limit its options if the United States proceeds with missile defense and space weapons."[7]

Assumption 2: China appreciates the strategic deterrent value of antisatellite weapons.

Whether by design or not, China realizes its ASAT test represents some measure of deterrent value. If China meant to send a message, it aimed it at US leaders supporting missile defense and Taiwanese intervention. China's subsequent actions will indicate which model of strategic deterrence it has decided to follow. A small "credible deterrent" based on Chinese nuclear doctrine may only require a few ASAT weapons, in which case further testing may not be needed. However, if China pursues mass development and deployment of its newly tested ASAT capability, more tests will follow, suggesting that PLA strategists have embraced the "real war-fighting potential" of space weaponry in addition to its inherently deterrent attributes.

Assumption 3: China aspires for greater relevance within the international space community.

China believes it has attained a new level of status among the space-faring nations. The PRC is still looking for new ways to expand its cooperation and influence in international space politics.[8] Although it is engaged in a number of ongoing cooperative ventures with the Europeans and Russians, Beijing is not satisfied with its role in the larger multilateral space dia-

logue. Following on the heels of its successful manned-space program, China's ASAT demonstration places it among the top three space-faring nations that have successfully knocked a satellite out of orbit. The implication is that China must now be recognized as a major contributor toward any future discussions on the space environment.

Assumption 4: China believes space weapons are an obvious prerequisite to becoming a major space power.

China appears to have the political will, national resources, and technological elements necessary to become a major space power. China's emerging military space doctrine is informed by its time-honored precepts of asymmetric strategy, a pervasive sense of techno-nationalism, and a new revolution in military affairs aimed at propelling the PLA into the age of informationized warfare.[9]

Assumption 5: China does not harbor any expansionist intentions.

Beyond reunification with Taiwan and the resolution of other relatively minor territorial disputes along its borders and in the South China Sea, the PRC has no grand imperialistic design. However, China does seek greater influence in world events and anticipates the need to compete globally for energy resources in order to preserve national sovereignty.[10]

Methodology

Superior strategists understand the benefit of framing complex problems using multiple perspectives. Intractable security dilemmas require a multifaceted approach that musters the resources of all national instruments of power. Furthermore, newly emerging systemic-planning models assist strategists in choosing options that are well integrated both vertically and horizontally. Luttwak points out that "the entire realm of strategy is pervaded by a paradoxical logic very different from the ordinary 'linear' logic by which we live in all other spheres of life."[11] The options considered in this systemic approach were chosen, in

part, for their paradoxical value. However, in choosing the alternatives explored in this paper, the author strove to stretch but not break the fiscal and political boundaries that will continue to shape America's choices in space. It is common knowledge that many things are possible with unlimited resources; and just as it is unwise to expect a nation to act counter to its own interests, it is equally unwise to promote options that fail to align vertically within the political and economic spheres.

As Luttwak's work has now been referenced several times (and as a primer for additional references forthcoming), it may be prudent to further explore his model of the vertical and horizontal dimensions of strategy, as outlined in his book *Strategy: The Logic of War and Peace*. Of particular relevance is the way he modifies his framework when discussing elements of grand strategy, as opposed to military strategy where he employs a different approach. Luttwak writes that a "grand strategy may be seen as a confluence of the . . . interactions that flow up and down level by level, forming strategy's 'vertical' dimension, with the varied external relations among states forming strategy's 'horizontal' dimension."[12] The methodology applied in this work, therefore, draws upon Luttwak's "grand strategy" model to first explore various response options along the vertical dimension of each instrument of power and thereafter craft a complement of options across the horizontal dimension to ensure that an enduring, harmonious solution set emerges. The answer to the question, how should the US respond, lies in an integrated strategy that requires the input of multiple agencies within the federal government. The familiar DIME—diplomatic, informational, military, and economic—model provides four broad vertical dimensions, and successful integration across these dimensions produces horizontal harmony (see fig. 1).

Sources such as congressional testimony; space fora transcripts; US, foreign, and UN government reports; and personal interviews represent the bulk of the primary source data used in this research. Secondary sources such as books, professional journals, periodicals, electronic media, and unpublished research projects are used to support and contextualize the arguments in each dimension. The author has carefully selected options based on the five aforementioned assumptions regarding China's employment of space weaponry and

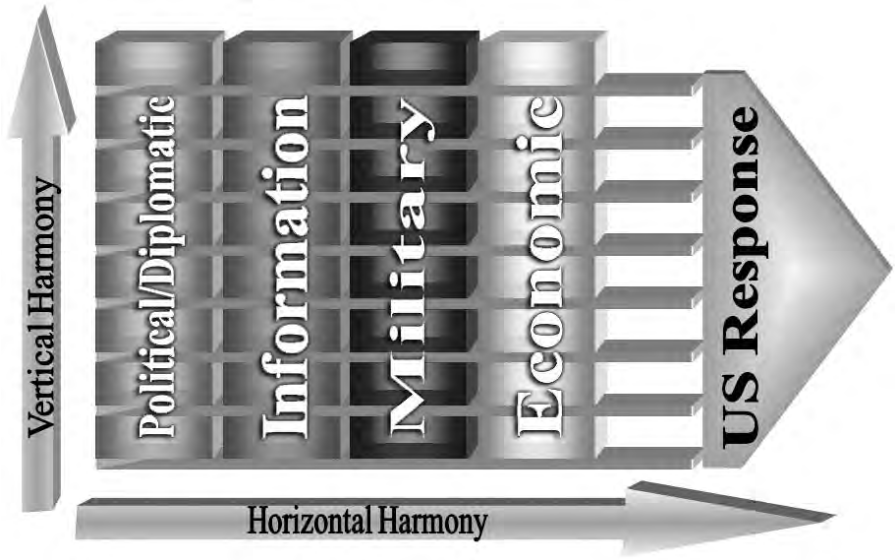

Figure 1. Adaptation of Edward Luttwak's model of horizontal and vertical harmony. (*Adapted from* Edward N. Luttwak, *Strategy: The Logic of War and Peace* [Cambridge, MA: Belknap Press of Harvard University Press, 2001].)

well-established norms that govern political and fiscal boundaries. The final chapter represents a set of options and offers an analysis of the timing and magnitude necessary to achieve vertical and horizontal harmony.

Thesis

The current paradigm, which dictates that national security space is largely a unilateral effort and for years has governed US policy and activities in this arena, is no longer valid. The only proper US response to China's ASAT demonstration is one that properly aligns the US instruments of national power to produce an enduring, coherent, multilateral approach toward space power. Fundamental changes in the way the United States approaches national security space are long overdue. Poorly imple-

mented policies and futile strategies have hitherto failed to ignite any sense of urgency or rationality in Washington. China's test must serve to demark the end of failed American assumptions vis-à-vis its future competitive edge in space. As Gen Lance Lord, USAF, retired, often observed, "Space superiority is not America's birthright, but it can be its destiny."[13] However, it is no longer clear whether America should pursue its destiny alone.

Diplomatically, the United States must extract the previously ignored kernels of soft power inherent in its dominant national security space enterprise. A new international security space alliance could enhance the security and influence of all like-minded space-faring nations. In good faith, American diplomats must pursue treaty options that preserve the space environment without dulling the asymmetric advantage their country currently wields. Finally, widely accepted confidence-building measures that effectively diminish the likelihood of escalatory space engagements have become imperative.

Through information, as an instrument of national power, the United States must pursue a more nuanced understanding of the Chinese military space culture. Transparency cannot be achieved by sending an envoy to Beijing requesting access to China's military budgets. True transparency must be achieved through routine, sustained engagement. Military-to-military engagement at the senior-officer level must serve as a model for continued engagement throughout the chain of command. At the same time, the United States must increase the prominence of its commitment to strategic and tactical space intelligence. At the strategic level, the intelligence community must provide a workforce with the requisite skill sets to interpret the newly contested environment. Tactically, commanders and collectors must optimize the flow of information and integrate processes and capabilities to ensure timely military response options are available.

Economically, Washington policy makers must fix the repressive policies that have unnecessarily stunted the growth and success of space industry stakeholders. Technology export-control restrictions have marginalized the very satellite industry congressional leaders strove to protect. Ineffectual policy adjustments will not correct this paradox. The horizontal disharmony resulting from America's export policies has spawned new global

markets with foreign entities that have, in turn, become increasingly competitive with US corporations. It is time to allow the US space industry to compete fairly with global competitors and reaffirm its title as the world's leader in space.

Finally, America's military forces must attend to the immediate crisis that is space situational *unawareness*. In concert with the aforementioned policy changes, the US military must take the lead in forming an international security space alliance. By implementing a shared space-surveillance strategy, military commanders can set standards for interoperability and shape the requirements process for all participating nations.

Notes

(All notes appear in shortened form. For full details, see the appropriate entry in the bibliography.)

1. Gertz, "Chinese Still Silent on Space Weapons."
2. Butler, "Bush Memo Orders Space Situational Awareness."
3. Luttwak, *Strategy*, 259.
4. Unfortunately, they are rarely translated by foreign governments. Shambaugh, "China's Military Views the World," 56.
5. Of these institutes, the PLA's Academy of Military Science and National Defense University are the most reputable. See Pollpeter, "Chinese Vision of Space Military Operations," 330. Dr. Larry Wortzel is a retired US Army colonel and is a leading authority on China, Asia, intelligence issues, foreign policy, national security, space policy, and military strategy. Wortzel says that

> in China, the materials that Dean [Cheng] and I primarily exploit or pay attention to come out of the Academy of Military Science, their National Defense University, the Nanjing Command College, the Navy, the Second Artillery and the Air Force Command Colleges, some of the logistics institutions and some of the engineering colleges. They are not transparent in terms of policy and intentions, but you really can get a fair picture of future doctrine if you can either get someone to translate it for you or you read Chinese at that level.

See Wortzel and Cheng, "China's Military Ambitions in Space."

6. The context provided here is based upon research the author conducted in 2007 while a student at the Naval War College. The entire body of work explores five possible hypotheses:

> (1) China's antisatellite test was designed to gain leverage against the United States to ratify a new international Space Treaty; (2) China is developing an antisatellite capability as a strategic space deterrent; (3) The motivation behind China's ASAT test can be summarized in one word: Taiwan; (4) China's ASAT test marks a milestone in its military

> modernization efforts—it represents an incremental development in the broadly evolving space doctrine of a nation intent on becoming a major space power; and (5) China's decision to test an ASAT weapon was an unfortunate miscalculation, the result of overzealous PLA leaders pursuing a program which was overly compartmentalized, poorly communicated, and ineffectively coordinated. The political-military balance of power in China is clearly misaligned.

See Mastalir, "China's ASAT Test," 113–16.

7. Chang et al., *Military Astronautics*, 152, 168, 243. Quoted in Hagt, "Mutually Assured Vulnerabilities in Space," 96.

8. Saunders and Lutes, "China's ASAT Test," 2.

9. The term *techno-nationalism* is the idea that "technology is fundamental to both national security and economic prosperity, that a nation's development policy must have specific strategic underpinnings, and that technology must be indigenized at all costs and diffused system wide." Feigenbaum, *China's Techno-Warriors*. For a discussion on how techno-nationalism guides China's comprehensive national development, see Johnson-Freese and Erickson, "Emerging China-EU Space Partnership," 15. In September 2003, Jiang Zemin announced a new stage of PLA modernization that he characterized as a revolution in military affairs (RMA)–based military reform. He ushered in the new era of advanced technologies (including nanotechnologies, space technologies, and electromagnetic weapons). His goal: create a smaller, well-educated PLA army of high quality (such as the American forces). Major changes in military financing also took effect: the proportion of weapons purchases increased from 32.3 percent in 2000 to 33.8 percent in 2002, and passed 35 percent in the 2003–4 timeframe. The share of expenses for the Air Force, Navy, and Second Artillery increased—specifically, significant money was assigned for establishing *space troops* as a new kind of PLA forces. According to the article "Mastering New RMA Trends," published in *Jiefangjun Bao* (official paper of the PLA) on 28 October 2003, the major directions of the current RMA in the PLA include that the Strategic Missile Corps should improve capabilities for mobile strikes and real-time strikes, while the Air Force should develop capabilities related to *space troops, satellite striking systems*, and unmanned aerial vehicles. Nemets, "PLA 'Modernization Building,' " 3.

10. This assumption may be difficult for some military professionals to accept, nonetheless, it is well supported in US national policy. Consider the following excerpt from a 2008 report to Congress: "The United States welcomes the rise of a stable, peaceful, and prosperous China. No country has done more to assist, facilitate, and encourage China's national development and its integration in the international system. The United States continues to encourage China to participate as a responsible international stakeholder by taking on a greater share of responsibility for the stability, resilience and growth of the global system." DOD, *Annual Report to Congress*, 2007, I.

11. Luttwak, *Strategy*, 2.

12. Ibid., 209. Much of Luttwak's book is dedicated to military strategy, wherein the horizontal dimension refers to the action and reaction of "adversaries who seek to oppose, deflect, and reverse each other's moves" (xii).

When discussing grand strategy, Luttwak suggests that the horizontal dimension refers to the "varied external relations among states" that can draw upon multiple instruments of power (209). His use of the vertical dimension remains consistent at all levels of strategy.

13. Gen Lance W. Lord (commander, Air Force Space Command, Peterson AFB, CO), in discussion with the author, 2005–6.

Chapter 2

Extreme Dimensions

We have a long way to go in the space race. We started late. But this is the new ocean, and I believe the United States must sail on it and be in a position second to none.

—Pres. John F. Kennedy, 1962

Response Option: America's response is bounded by two extremes: defeat the Chinese in a good old-fashioned American space race . . . or simply do nothing.

The Chinese have developed an ASAT, but few can be certain as to why. Inability to answer the primary question makes the subsequent question considerably more challenging. How should the United States respond? One might turn to history as a means to illuminate the way ahead. Historian Williamson Murray argues that "history will always present the military professional with considerable difficulties. But the past can suggest how to think about new contexts and different challenges. It is almost never predictive. It can only suggest a range of possibilities and thinking about the future."[1]

Indeed, the historical evidence indicates a range of possibilities that might govern America's response. The 1957 Soviet launch of *Sputnik I* sparked an international competition that landed US astronauts Neil Armstrong and Edwin "Buzz" Aldrin on the moon a little over a decade later. The moon landing marked the pinnacle of the space race, and American investment in the space program thereafter declined accordingly—the National Aeronautics and Space Administration (NASA) cancelled the last three Apollo missions due to lack of interest.[2] Concerned US leaders turned their attention toward the stars again in September 1972, when the Soviets launched their first early-warning satellite, *Cosmos 520*, into a highly elliptical orbit unfamiliar to North American Aerospace Defense Command (NORAD) trackers. Panic ensued until the end of December 1972 when NORAD finally obtained the spacecraft's orbital ele-

ments on a regular basis.[3] By 1983 the nuclear standoff with the USSR precipitated *Star Wars*, the famous US Strategic Defense Initiative (SDI) that mobilized the aerospace industry to deploy a space-based system capable of destroying thousands of incoming Soviet ballistic missiles.[4] Before the end of Pres. Ronald Reagan's second term, the administration determined the plan was no longer feasible and scaled back the effort. In 2000 the Space Commission, formally called the Commission to Assess United States National Security Space Management and Organization, began a comprehensive national security space review. The report's findings promised significant changes, and the DOD subsequently enacted many of its recommendations; however, the 11 September 2001 terrorist attacks in New York and Washington, DC, diverted much of the public attention the issue richly deserved.[5]

Historically, therefore, America's interest in the pressing issues derived from strategic space dilemmas has been somewhat transitory—even the most vigorous US responses have proven to be relatively short-lived. Antonio Pensa, a United States Strategic Command (USSTRATCOM) space expert of over 35 years, correctly observed that "this nation's interest in space has been, at best, very episodic."[6] However, the question remains—which *episode* will emerge in the aftermath of the 2007 Chinese ASAT test? The historical perspective bounds the problem at two extremes: embrace an all-out space race, or simply do nothing. While one might argue that fringe options rarely prevail, it is worth exploring the possibilities offered at the extremes, if for no other reason than to rule them out.

Space Race

Gen Michael Moseley, former US Air Force Chief of Staff (CSAF), called China's test of an ASAT weapon a "strategically dislocating" event as significant as the Soviet launch of *Sputnik* in 1957.[7] Others took the analogy much further. In fact, journalists, scholars, and bloggers virtually tripped over themselves in a rush to sound the alarm warning everyone of the forthcoming space race. With so many publications invoking memories (and fears) of the nuclear buildup between the United

States and the Soviet Union, the alleged missile gap, and the Cuban missile crisis, one is left to wonder how long before 1/11 is compared to 9/11.

China's demonstration was a boon for space weapons advocates who quickly seized the opportunity to promote their agendas. Hank Cooper, former director of President Reagan's SDI and chairman of a missile-defense advocacy group, proclaimed, "I hope the Chinese test will be a wake up call to people. I'd like to see us begin a serious anti-satellite program. We've been leaning on this administration. This argument to prevent weaponization of space is really silly!"[8] Several members of the House Armed Services Committee who share Cooper's views immediately launched a push for more spending on classified space programs, stating that China's recent antisatellite test ushered in a "new era of military competition."[9] US senator Jon Kyl took an even more direct approach, suggesting the United States develop offensive and defensive technologies to deal with ASAT weapons, including space-based systems that can disable or destroy enemy ASAT weapons, and space-based missile interceptors that could destroy a rocket carrying an ASAT payload before it leaves the atmosphere.[10]

In contrast to the outspoken rhetoric embraced by politicians and advocacy groups, the nation's uniformed personnel remained somewhat measured in their assessment of the pending space race. During his 2007 congressional testimony, Gen James Cartwright, US Marine Corps (USMC), then USSTRATCOM commander, questioned whether the Chinese space-arms program should lead the United States to develop similar weapons. "We have the technical capability," he said. "My belief right now is, knowing what we believe we know about this threat after the demonstrations, that it is premature to start thinking about an arms race in space. . . . We do not have to have a space response to that threat."[11] Gen Peter Pace, USMC, then chairman of the Joint Chiefs of Staff, told senators he did not believe China intended to use such an ASAT weapon anytime soon. "On the other hand, it is a unique capacity in the world. And we need to, in a very separate conversation, take a look at where are we with regard to that capacity, where should we be, and if there is a gap, how we close it," Pace concluded.[12]

Closing a capabilities gap and mobilizing an all-out space race are two very different notions. Too many analysts have been enticed to conclude that China's ASAT demonstration will likely energize a new bilateral space race between the United States and China. Admittedly, the *Sputnik* analogy is attractive. However, in his seminal work, *Analogies at War*, author Yuen Foong Khong urges those who employ analogical reasoning "to separate what is clearly 'known' about the relationship and what is 'unclear' or 'presumed.' "[13] Furthermore, analysts should carefully inspect the history of an issue before employing analogies that may or may not fit the historical context.[14] Unfortunately, historical context fades with time. Many analysts seem to have forgotten that the space race between the United States and the USSR, with which they frequently identify, was squarely a product of the Cold War—national prestige versus national prestige.[15] Virtually none of the strategic drivers that drove the frenzied acquisition of space technologies necessary to land Neil Armstrong and Buzz Aldrin on the moon are present in today's geopolitical climate.

First, China and the United States are not bitter enemies. Although tensions between the two countries *ebb and flow* due to varying national interests, such as the security and sovereignty of Taiwan, the United States and China enjoy relatively strong economic ties that dictate the necessity for cooperation more so than competition. Consider the following excerpt from a 2008 DOD report to Congress: "The United States welcomes the rise of a stable, peaceful, and prosperous China. No country has done more to assist, facilitate, and encourage China's national development and its integration in the international system. The United States continues to encourage China to participate as a responsible international stakeholder by taking on a greater share of responsibility for the stability, resilience, and growth of the global system."[16]

Second, current fiscal realities preclude the type of rapid buildup demonstrated during the Cold War–era when resources were not a limiting factor. President Kennedy and Pres. Lyndon Johnson provided unlimited funding to NASA for virtually anything the agency deemed relevant to space exploration. As vice president, Johnson rationalized that "failure to master space means second best in every aspect, in the crucial arena of our

Cold War world. In the eyes of the world, first in space means first, period; second in space is second in everything."[17] The fiscal constraints of today are far different. The US secretary of the Air Force serves as the DOD's executive agent for space.[18] Unfortunately, the Air Force budget is emaciated. General Moseley's plan to recapitalize the USAF aircraft inventory by mortgaging nearly 40,000 military personnel fell flat when the Bush administration proposed increases in Army and Marine Corps end strength.[19] Furthermore, its space acquisition arm has shown only isolated signs of efficiency after a string of cost and schedule overruns brought the entire space industry under fire from multiple US congressional committees.[20] A 2008 Government Accountability Office (GAO) report shows that five major space recapitalization programs initiated within the last 10 years continue to incur substantial cost growth and schedule delays.[21] Finally, operations in Iraq and Afghanistan have placed the Defense Department's coffers in an extremely compromised position at the same time as the new administration wants to trim overall defense spending.

Likewise, China is hardly prepared to appropriate exorbitant amounts of money into space weaponry. Hui Zhang remarks that "China's most urgent national objective is economic growth. It needs a stable international security environment to concentrate its resources on economic development. Chinese security analysts are mindful that the [US SDI] in the 1980s induced the Soviet Union to waste resources in response."[22] As one Chinese official stated, "China is not in a position to conduct [an] arms race with [the] US and it does not intend to do so."[23] More to the point, a Chinese analyst observed that "China does not have the ability to enter a space weapons race."[24]

Chinese ambassador Hu Xiaodi may have best characterized the Chinese perspective when he remarked in 2001 that

> the country that takes the lead in deploying weapons in space will enjoy an advantage for a period, but it will not be able to monopolize space weapons. Other states, when they find it affordable economically, scientifically and technically, will follow suit at a different pace and scale. This may not generate a space arms race in its strict sense (because other states are not really competing with the leading power), but the space weapon arsenal will inevitably develop and increase both qualitatively and quantitatively. As soon as the weapons are deployed in outer space, the international community will have to change its efforts from preventive ones to the aim of *space disarmament*. Soon afterwards, as a few other countries (major powers) also have put their weapons in the

> arena of outer space, there will be an attempt towards *space weapon non-proliferation*—that is, let the *haves* continue their privileged position, while prohibiting other *have-nots* from accessing space weaponry. In other words, an old story will unfold in a new form."[25] (emphasis in original)

The clamoring of wide-eyed analysts over the dangers of an imminent space race falls mute against the realities of the US-PRC geopolitical environment, economic interdependencies, and fiscal constraints. The *Sputnik* analogy simply does not hold up. If China and the United States each decide to pursue space weaponry, they will likely do so with caution and prudence. The imperative for stability continues to underwrite China's military modernization efforts, while the United States wrestles with global commitments and a rapidly aging military infrastructure.

Do Nothing

If "Space Race II" represents one extreme, the opposite end of the spectrum is the null set; that is, the United States could simply choose to do nothing. US leaders could view China's ASAT test as nothing more than a technology demonstration, an appropriate milestone for a burgeoning space power that has developed satellites since 1970, achieved human spaceflight, and recently launched its first lunar orbiter.[26] In 2006 reports surfaced suggesting China had dazzled an American reconnaissance satellite as it passed over Chinese territory. Later, US military officials acknowledged that the Chinese had indeed attempted to blind or disrupt signals of a US satellite flying over Chinese territory.[27] What was the US response? Nothing. The point: China's experimentation with space weapons is nothing new.

The *do nothing* option is predicated on the belief that China's activities do not constitute a threat to the United States—a notion that has been debated within US intelligence and policy circles. Some defense officials have argued in interagency meetings that the ASAT weapon test was "a one-time event that poses no strategic threat."[28] International affairs experts, such as Thomas Schelling, maintain that *intent* and *capability* are

two essential elements that constitute a credible threat.[29] With respect to China, ambiguity lies in both.

China's intent has been difficult to discern considering its wholly inadequate response to the international fervor its ASAT test created. Some continue to argue that China has the most to gain by avoiding a military conflict with the United States. The argument regarding China's close trade relationship with the United States again becomes germane and warrants further examination. In 2007 estimates of China's trade deficit with the United States reached nearly $300 billion, representing nearly half the overall American trade deficit.[30] Many US and other multinational companies are investing about $1 billion per week to expand their China-based operations.[31] While these numbers are intriguing, they merely represent the more fundamental argument of *ideological compatibility*, which is why US policy makers may largely overlook China's ASAT test. In *Triangulating Peace*, authors Bruce Russett and John Oneal observe that "the rise of China does not recreate a danger like the Cold War conflict between NATO and the Warsaw Pact because China is no longer driven by an ideology that is incompatible with good, mutually beneficial relations with the West."[32] Whereas the Soviet Union abhorred capitalism, China has embraced it as a means to fuel unprecedented economic expansion, the bedrock of its modernization efforts in all sectors, including the military. Its trade relationship with the United States lies squarely at the heart of its economic success.

The extent of China's true capability in space warfare is also somewhat ambiguous. In many respects, China's test is an impressive demonstration of technological achievement. However, translating this knowledge into a viable operational capability will take considerable time and skill. It remains to be seen just how exactly China intends to do this, if at all. The reality is that a large-scale attack on America's space assets would be rather difficult to achieve, at least without warning. In arguing that China could not possibly win a space war with the United States, former UN weapons inspector and strategic weapons analyst Geoffrey Forden takes a close look at how China's presumed ASAT capability matches up against US space assets. Forden concludes that, given the worst-case scenario, China could *reduce* but not *cripple* US military capabilities. He reveals

that "back in 2001, a commission led by Donald Rumsfeld warned of a 'space Pearl Harbor,' a single strike that could cripple America's satellite network. It turns out, there is no such thing."[33] Forden may be right, at the moment; however, this only suggests that the US response should not forsake coherency for exigency.

Summary

Neither the United States nor China is seemingly able to afford a space race, and the ambiguities regarding China's threat capacity that make the null set possible also make it impractical as a national security policy. Consequently, an examination of the extreme options suggests that neither represents an appropriate strategy for countering China's employment of space weaponry. Until more information becomes available, perhaps the best course is to develop a comprehensive, integrated response that brings to bear all US instruments of national power. The Chinese made one irrefutable point abundantly clear—America's space assets are vulnerable to attack. Although military space leaders have made the same point on numerous occasions, the Chinese have managed to express it in a way that has finally caught the attention of US decision makers. Additionally, some military commanders have already recognized the need for a multifaceted approach. Brig Gen C. Donald Alston, former director of Air, Space, and Information Operations at Headquarters Air Force Space Command (AFSPC), observed that "other elements of national power should be used to reduce the danger of war in space, including diplomacy, economic measures and 'engagement' to produce a dialogue aimed to preventing space attacks."[34] It is time to explore such alternatives and seek harmony in the vertical and horizontal dimensions.

Notes

1. Murray, "Thoughts on Military History," 92.

2. This investment decline actually began prior to the moon landing. McDougall, *Heavens and the Earth*, 10. See also "1969: Man Takes First Steps on the Moon"; and Johnson-Freese, *Space as a Strategic Asset*, 58.

3. Podvig, "History and the Current Status of the Russian Early Warning System," 27.

4. Lennon, *Contemporary Nuclear Debates*, 5–6.

5. Commission to Assess United States National Security Space Management and Organization, *Report of the Commission*, 9–12; hereafter cited as the Space Commission Report.

6. Pensa, "Overview of Space Issues."

7. Harrington, "Chinese ASAT Test Prompts US Rethink."

8. O'Brien, "Fanning Fears of a Space War."

9. Scully, "House Republicans Call for Greater Military Effort." House Armed Services ranking member Cong. Duncan Hunter, R-CA, and House Armed Services Strategic Forces Subcommittee ranking member Cong. Terry Everett, R-AL, wrote a letter to President Bush contending that space systems are "integral to the daily execution of virtually every military campaign, operations and exercise involving U.S. forces today." They called on the administration to review Defense Department programs that protect US space assets, and they encouraged the development of new systems (ibid.).

10. Singer, "Senator Criticizes Bush for Tepid Response."

11. Gertz, "China Has Gained and Tested Array of Space Weapons." Cartwright testified before the Senate Armed Services Committee Strategic Forces Subcommittee in March 2007. *Defense Authorization Request for Fiscal Year 2008 and the Future Years Defense Program: Statement of General James E. Cartwright.*

12. "US Defense Chief Troubled by Chinese Anti-Satellite Test."

13. Khong, *Analogies at War*, 255.

14. Ibid.

15. Frost, "Introduction to Space"; and McDougall, *Heavens and the Earth*, 6–9.

16. DOD, *Annual Report to Congress*, 2007, I.

17. Hirsch and Trento, *National Aeronautics and Space Administration*, 107. Quoted in McDougall, *Heavens and the Earth*, 8.

18. The summary to DOD Directive 5101.2, *DoD Executive Agent for Space*, states that

> pursuant to the authority vested in the Secretary of Defense under 10 U.S.C. 113, and consistent with the policies in DoD Directive 3100.10, this Directive: Establishes policy and assigns responsibilities and authorities for the planning, programming, and acquisition of space systems within the Department of Defense . . . ; Designates the Secretary of the Air Force as the DoD Executive Agent for Space in accordance with DoD Directive 5101.1; Implements and supersedes paragraph 3.2 of Secretary of Defense Memorandum, "National Security Space Management and Organization," 18 October 2001, consistent with DoD Instruction 4000.19, and supersedes DoD Directive 5160.32.

19. Sherman and Roque, "Bush to Announce Bigger Army." According to defense officials, President Bush wants to "increase the permanent size of US ground forces by as many as 90,000 uniformed personnel, the first such significant boost in end-strength since the fall of the Soviet Union.

20. Tirpak, "Beyond 'Back to the Basics.' "

21. These programs include the (1) Advanced Extremely High Frequency (AEHF) communications satellite program, (2) National Polar-orbiting Operational Environmental Satellite System (NPOESS), which DOD is jointly developing with the National Oceanic and Atmospheric Administration, (3) Space-Based Infrared System (SBIRS), which detects missile launches, (4) Wideband Global Satellite Communications (WGS), another communications satellite, and (5) Global Positioning System (GPS) IIF program. Senate, *Space Acquisitions*.

22. Podvig and Zhang, *Russian and Chinese Responses*, 44–45.

23. Fu, "Concerns and Responses," quoted in Podvig and Zhang, *Russian and Chinese Responses*, 36.

24. Bao, "Deterrence Revisited: Space," 10.

25. Hu, "A Treaty to Prohibit Weapons and War in Space?" quoted in Podvig and Zhang, *Russian and Chinese Responses*, 40–41; and Hu, "Missiles: How Can We Reduce the Dangers They Pose?" quoted in Podvig and Zhang, *Russian and Chinese Responses*, 45.

26. "Concern over China's Suspected Weapon Test."

27. Fabey, "China Sat Disrupting Efforts," 3. National Reconnaissance Office director Donald Kerr acknowledged that something had happened but that "it did not materially damage the U.S. satellite's ability to collect information." Shalal-Esa, "China Jamming Test."

28. Gertz, "US Satellites Dodge Chinese Missile Debris."

29. Schelling, *Arms and Influence*, 92–93.

30. Weisman, "US-China Trade Talks."

31. Scott and Coumatos, "Why China Won't Start a Space War."

32. Russett and Oneal, *Triangulating Peace*, 293.

33. Forden, "How China Loses the Coming Space War."

34. Gertz, "Beijing Space Test Scattered Debris." General Alston has since moved on to become the director of Space and Nuclear Operations, Office of the Deputy Chief of Staff for Air, Space, and Information Operations/Plans and Requirements, Headquarters US Air Force, Washington, DC.

Chapter 3

Political/Diplomatic Dimension

The art of policy is to create a calculation of the risks and rewards that affect the adversary's calculation.

—Henry Kissinger

Response Option: America's response must be one of diplomacy. A fresh policy perspective, new space treaties, international confidence-building measures, and escalatory restraints are the keys to protecting America's space assets.

US diplomatic relations with China have long been bipolar, alternating between *containment* and *engagement*.[1] The 2006 *Quadrennial Defense Review* recognizes China's "potential to compete militarily with the United States" and at the same time identifies China as a "partner in addressing common security challenges."[2] Likewise, the 2008 Defense Department assessment of the PRC's military power warns that "much uncertainty surrounds China's future course, in particular in the area of its expanding military power and how that power might be used," but "welcomes the rise of a stable, peaceful, and prosperous China."[3] Sir Lawrence Freedman maintains that throughout the Cold War, policy experts relied on containment strategies to counter the assumption that communism was naturally expansionist and so could only be held through the threat of force. He advocated that "containment as an objective lent itself to deterrence as a method."[4] However, it was the policy of engagement, which peaked in the 1990s, that has propelled economic globalization and has made China one of the United States' top trading partners. The result has been a hedging strategy that continues to expose a variety of inconsistencies and vertical disharmony with how America conducts foreign policy.

Space as an Element of Soft Power

One aspect of America's foreign policy that is arguably undervalued is what Joseph Nye calls *soft power*. According to Nye,

"Soft power is the ability to get what you want through attraction rather than coercion or payments. It arises from the attractiveness of a country's culture, political ideals, and policies."[5] The concept of soft power is readily apparent in the way China has managed its rise to power. For example, one of China's most influential leaders of modern time, Deng Xiaoping, instilled in his foreign-policy apparatus the "24-character strategy": "observe calmly; secure our position; cope with affairs calmly; hide our capacities and bide our time; be good at maintaining a low profile; and never claim leadership."[6] However, Chinese officials deliberately exclude Deng's maxim from publicly circulated leadership speeches and documents to avoid stimulating additional concerns abroad that China will pose a threat once it becomes powerful. The same appreciation for soft power was evident in China's decision to reject the term *peaceful rise* in favor of the less threatening term *peaceful development* in April 2004.[7] China has also been careful to mitigate the external counterbalancing forces that invariably arise within the international security environment when a single nation amasses power. Ashley Tellis has identified a number of techniques employed by China to continually balance external forces: theories of peaceful ascendancy, the use of economic leverage, the promotion of good-neighbor policies, the possible provision of public goods over time, and, finally, exploiting regional dissatisfaction with the United States.[8] A 2005 Pew Global Attitudes Project survey suggests China's efforts to produce a favorable image have paid off. The report notes, "Strikingly, China now has a better image than the US in most of the European nations surveyed."[9] Of course, US diplomacy is still capable of achieving results—soft power alone does not dictate the necessities of the security environment. Furthermore, China's ASAT demonstration may have opened some doors for American diplomats.

The United States derives its soft power from many sources, yet disharmony in the vertical dimension of foreign policy seems all too often to generate counterproductive results. Furthermore, there is an element of space to soft power that often gets overlooked by policy makers. Simon Worden, director of the NASA Ames Research Center explains, "I recall when I worked for the national space council at the White House. They ignored us most of the time but whenever the President was going to talk with

somebody, it could be Botswana, and they didn't have anything to talk about they could always talk about space. It became a real positive entrée." Worden argues that the most intensive and impressive application of space, as an element of soft power, is not supporting the war fighter, but rather, preventing wars. He concludes that "until we figure out how to do that and how to work with other people we're going to have an increasing problem. Others are only going to take advantage of it."[10]

It has become common in space-policy circles to criticize US space policy for negating the element of soft power by projecting a defiant, zero-sum view concerning other nations' access to space capabilities. Indeed, some of the criticism is justified, and US policy writers could have avoided such criticism in the same way Chinese policy writers substituted the word *rise* with *development.*[11] Albeit to a far lesser extent than its 1996 predecessor, the 2006 *U.S. National Space Policy* allows for and encourages the cooperation and engagement necessary to embrace a multilateral approach toward space exploitation. For example, a major principle of the policy states that "the United States will seek to cooperate with other nations in the peaceful use of outer space," and one of its fundamental goals is to "encourage international cooperation with foreign nations and/or consortia on space activities."[12] Based on this broad guidance, new diplomatic initiatives are possible—initiatives that can strengthen America's ability to influence the strategic environment of space.

International Security Space Alliance

In the future, America must increasingly rely on alliance and coalition efforts to shape its security environment. The global war on terror serves as a daily reminder of the importance of strong alliances with other nations. The 2006 *Quadrennial Defense Review* noted that to realize its goals, the Department of Defense must "join in a collaborative partnership with key stakeholders in the process of implementation and execution—the Congress, other agencies of the Executive Branch and *alliance and coalition partners*."[13] (emphasis added) The United States has long sought cooperative ventures in civil space. The International Space Station is one prime example, although many other

cooperative ventures, including an unprecedented 19-nation unmanned mission to Mars, took place throughout the 1990s.[14] With few exceptions, when it comes to national security space, America has been less willing to join an international team. Gen Thomas S. Moorman Jr., USAF, retired, claims that the problem lies not with US Space Policy, which he believes has been extremely consistent, but with its implementation, which he characterizes as "terrible." According to the general, "The missing link is a national space strategy . . . [and as part of that strategy] *international cooperation is going to become more important* than less important."[15] (emphasis added) China's military modernization efforts in space, punctuated by its 2007 ASAT demonstration, provide an opportunity for the United States to shape an international alliance of like-minded, space-faring nations.

American officials were shocked and dismayed by China's reckless demonstration of brute-force space weaponry. Air Force secretary Michael Wynne called the shootdown an "egregious act" and concluded that China now claims space as a "legitimate battlefield."[16] However, the United States is not the only country concerned about the future of space security. Leaders from many countries, including Britain, Australia, Canada, Japan, Taiwan, India, South Korea, and the European Union, joined the United States in its protest and called upon Beijing for consultations.[17] These leaders perceive China's ASAT capability as a direct threat to their own space assets, many of which revolve in orbits similar to China's target satellite, the *Feng Yun-1C*.[18]

Given the universally negative reaction to China's actions, an opportunity exists to form an international security space alliance. The benefits of such an alliance are numerous. The United States could offer enticements, such as unprecedented access to its extensive space network, fewer restrictions on technology exports, and increased access to other space products. In return, the United States could negotiate standards for collectively acquired and shared space systems. Such systems could eventually include missile warning/defense, communication, navigation, remote sensing, and space surveillance.

As an instrument of policy, US leaders must carefully consider the advantages and disadvantages of increasing partnership capacity in each national security space–mission area. For example, a shared-source, multilateral space surveillance net-

work (SSN) distributed among alliance partners could achieve several objectives. Real-time data about the location of all space objects would decrease tensions about the purpose and activities of each nation's spacecraft. Future technologies will enable a robust SSN to characterize attacks from within the space domain, as well as terrestrial-based attacks. The real-time capability to detect and geolocate directed-energy attacks from the ground, for example, would be a powerful deterrent against any who may consider such hostile acts. Of course, the apparent disadvantages include sharing the location of sensitive national payloads (useful for targeting), the risk of weapons technology proliferation, and the inherent risks of employing an open architecture. These issues will be revisited in due course.

One risk inherent in any US response is what Robert Jervis calls the security dilemma. Essentially, the security dilemma is a series of reactions whereby each adversary takes measures to counteract the other. In other words, if China builds ASATs, the United States must build counter-ASATs, and so forth. In offering suggestions to break out from a security dilemma, Jervis suggests that "one way to do this is to procure the kinds and numbers of weapons that are useful for deterrence without simultaneously being as effective for aggression."[19] Since space surveillance alone does not pose the same threat as missile defense or offensive space control, it could serve as the nonaggressive form of deterrence that Jervis describes.

Of course, the development of the technology and space systems necessary to produce a robust surveillance capacity, such as the one described above, will be extremely costly. Thus, another benefit of the space alliance is reduced cost through shared expense and the elimination of duplicative systems. There is growing evidence that other nations may be receptive to this concept. For example, Canada plans to launch *Sapphire* in 2011—a space surveillance satellite designed to integrate with the existing US space surveillance network of ground-based optical and radar sensors. From a sun-synchronous low-earth orbit, the satellite will survey objects, catalogue space debris, and monitor other nations' satellites.[20] *Sapphire*'s contribution to the SSN promises to significantly increase the network's capacity for space-based space surveillance (SBSS).

Other cooperative ventures in military space also lend credence to the idea of an international security space alliance. At the 2007 Strategic Space and Defense Conference in Omaha, Nebraska, French and Indian military leaders advocated joint sponsorship of imaging and signals-intelligence satellites for the purposes of space control. According to Lt Gen Patrick de Rousiers, commanding officer of the French Air Defence and Air Operations Command, "These efforts are not meant to create an alternative to a US-centric space control program, but to allow European nations to work on their own satellites to integrate information sent to ground forces."[21]

Why and How Will This Work?

The only legitimate answer to the first question is increased security, and NATO serves as an appropriate analogy.[22] In 2008 NATO celebrated its 60th anniversary, demonstrating an enduring capacity more impressive than the Outer Space Treaty. Encouraging nations to participate during the Cold War was relatively simple; the Soviets represented a common threat that unified the members of the alliance. Likewise, the modern-day proliferation of space weaponry, missile technology, and even nuclear weapons represents an increasing threat to all space systems. After the Cold War, many international security analysts believed NATO's future was uncertain, but NATO transformed to accept a broader scope of international engagement. Its continued involvement in Kosovo and Afghanistan demonstrates its enduring capacity to increase security for its member nations.

The continued relevance of the International Telecommunications Union (ITU) is another example of the enduring nature of organizations that effectively enhance security. The ITU traces its roots back to the nineteenth century, when international telegraph standards first became necessary.[23] Today, the ITU is an office within the United Nations that governs orbital slot assignments in the geostationary belt and performs frequency deconfliction. The ITU has no formal mechanism to enforce its standards, but space-faring nations comply to protect against interference from other satellites. Attorney and author Lawrence Roberts notes that the

> legitimacy of a legal structure has a powerful impact on efficiency. Like most international legal regimes, the ITU does not have the authority to enforce its rulings directly; it is dependent upon its own legitimacy to influence the behavior of its Members. As a consequence, the ITU's effectiveness is bound up in the Member's perception of the process's efficacy. As perceptions of legitimacy decline, the tendency increases for individual Members to act in their own short-term best interest, rather than in accordance with a legal system that, under ideal conditions, maximizes community benefit over the long-term.[24]

The issue of legitimacy shapes the answer to the second question, which becomes more palatable when one accepts that an international space alliance is neither a dovish nor hawkish approach to national security space. The debates regarding the US development of defensive and offensive space weapons must continue; after all, most NATO nations continue to build military capacity in excess of those forces each intends to contribute toward collective operations. Rather, the alliance would bring legitimacy and influence to the international dialogue that continues to shape responsible nations' activities in space. The very act of drafting an alliance charter and determining its conditions for entry provides member nations a platform to promulgate international norms for behavior. Would an international space alliance include a NATO-like Article 5 provision that states an attack on one member is an attack on all?[25] Perhaps it should, if the members believe such a provision would enhance security. But more important than a unified response to a space attack is the deterrent value in the assurance that every member of the alliance will know immediately when an attack in space has occurred, and by whom, and against whom. This subject deserves more scrutiny and receives it in chapter 6.

A truly cooperative approach to national security space will require policy endorsement from the highest level. The current US administration is looking for unique solutions to its security concerns in space, and the State and Defense Departments are exploring what data sharing could take place with friendly nations that also have space surveillance sensors.[26] Although the current national space policy encourages cooperation, too many other policies prohibit the kind of information sharing that would be necessary to make an international space alliance a reality. Current technology export laws and security

classification guidelines remain significant hurdles. However, since the United States has the most to lose, it therefore must have the most to offer others in exchange for cooperation.[27] The increased security derived from shared space surveillance data may be the catalyst for an international space alliance.

Treaties

> *American satellites are the soft underbelly of our national security and it is urgent . . . to guarantee their protection by initiating an international agreement to ban the development, testing, and deployment of space weapons and anti-satellite systems.*
>
> —Ed Markey, US representative, 2007

Tensions between the United States and China appeared high when US ambassador Christina Rocca criticized the Chinese delegation at the UN Conference on Disarmament meeting only one month after China's ASAT demonstration. If members present were hopeful that meaningful work toward a new space treaty might finally begin, disappointment soon displaced their optimism. In her summary, Ambassador Rocca stressed that

> we should focus our efforts on ensuring free access to space for peaceful purposes and deterring and dissuading the misuse of space, seeking universal adherence to the existing treaties and conventions to which not all members are signed up to. This is precisely what the United States national space policy states. We believe this approach will have more of a deterrent and dissuasion effect than an additional set of international constraints—constraints that would be unverifiable, protect no one, and constrain only those who comply and not those who cheat.[28]

Rocca concluded, as the United States has at nearly every previous session, by stating plainly that "there is no arms race in space, and therefore no problem for arms control to solve."[29]

Fundamental Challenges

The US position, as represented at the UN, identifies several fundamental challenges with using international legal instruments to control the development or employment of space weapons. The most difficult issue is *verifiability*. Treaties that lack the

necessary tools of verification must rely on trust. Of course, a lack of trust is what generally drives one to negotiate a legal instrument in the first place. President Reagan's maxim "trust but verify" holds as true for space weapons as it does for thermonuclear weapons. The Chinese side has believed, fairly accurately, that the United States will never sign such a treaty simply for lack of trust, fearing others will secretly pursue space-weapons capabilities while America's hands are tied.[30] This risk of breakout from the agreement by covertly developing or deploying prohibited or constrained capabilities to gain a military advantage makes prominent the requirement for verifiability.[31]

Problems also arise because space assets have an inherently *dual purpose*. For example, communication satellites can broadcast television services and at the same time transmit execution orders for a nuclear attack. Imaging satellites serve a critical role in disaster relief while providing strategic intelligence to military planners. The signals sent from position, navigation, and timing satellites guide tractors, trucks, and airplanes and enable financial transactions, as well as precision-strike munitions. The dual-use phenomenon is an equally challenging issue with which negotiators must contend when considering space arms control.

The issue becomes increasingly complex when one considers the use of defensive weapons, such as missile defense. The challenge lies in the faulty notion of a purely *defensive weapon*. Nearly every weapon known to man—perhaps with the exception of land mines and stationary flak cannons—can be employed in an offensive manner.[32] The critical test of whether a weapon is truly defensive, however, is whether the potential adversary views it as such.[33] Nations vehemently opposed to US missile defense, including Russia and China, believe the capability threatens their nuclear deterrent. Factoring in the concept of dual-use application, these same nations also contend that US missile defense is a poorly masked space weapon. With minor software modifications any weapon capable of shooting down a ballistic missile can also shoot down a satellite. Moreover, the satellite is an easier target since missile-defense radar systems can more easily track a satellite's position and velocity. The US Navy proved the point in February 2008 when the USS *Lake Erie*, a sea-based component of missile defense, shot down a

disabled US reconnaissance satellite after space experts determined the spacecraft's imminent reentry and toxic fuel supply posed a threat to inhabitants on Earth.[34] The challenges of treaty verification and the phenomenon of dual-use assets both cause serious problems for space treaty negotiations.

Presumably, the administration's space experts had carefully considered these problems as they finished the final draft of the 2006 *National Space Policy*. Robert Joseph, undersecretary for arms control and international security at the US State Department, delivered the first public comments about the policy, saying the United States sees "no value" in proposals to adopt a treaty prohibiting the weaponization of space and will continue to reserve the right to exercise "a full range of options from diplomatic to military" to defend its space assets.[35] However, the Chinese ASAT test has changed the thinking of some Washington policy makers, if for no other reason than the fact that thousands of pieces of new debris now endanger the assets of spacefaring nations everywhere. At least one congressman believes the Chinese satellite shootdown "should cause us to reconsider whether or not there should be some arms control regimen to restrict these kinds of tests" and the deployment of weapons in space altogether.[36] Most other nations agree. A recent UN resolution calling for the prevention of an arms race in outer space resulted in a 178-1-1 vote, with the United States voting in the negative and Israel abstaining.[37]

Possible Options

What kind of treaty makes sense for the United States to pursue? The options are few, considering the administration's commitment to missile defense, which is itself a product of failed arms control measures to stop the proliferation of ballistic missiles.[38] James Clay Moltz notes that "current treaties . . . allow unlimited testing of conventional weapons and lasers in space, the stationing of such systems in space, and the use of space for the interception of ballistic missiles or satellites by a variety of ground-, sea-, air-, and space-based systems."[39] These conditions allow the United States to pursue its missile defense programs free from international legal entanglements. Still, US space experts and politicians have become greatly concerned

about space debris; therefore, a small target of opportunity exists for those interested in some degree of space arms control.

Unfortunately, the 2002 Chinese and Russian–proposed UN resolution, banning the deployment of weapons in outer space, completely misses this target. The document provides for the following basic obligations: "[1] Not to place in orbit around the Earth any objects carrying any kinds of weapons, not to install such weapons on celestial bodies, or not to station such weapons in outer space in any other manner; [2] Not to resort to the threat or use of force against outer space objects; [and (3)] Not to assist or encourage other States, groups of States, or international organizations to participate in activities prohibited by this Treaty."[40] Broad ranging restrictions, as represented by the first point, typically fail when negotiators address issues such as space-based missile defense. The second point is too vague to be useful. What constitutes the "use of force"? One might argue that kinetic-kill attacks would fall into this category, but reversible tactics, such as laser dazzling and radio-frequency jamming, are not clearly prohibited by the language proposed. Still, the second point warrants further scrutiny and will be addressed shortly.

Essentially, the international community can agree that it wants to preserve the space environment to ensure members' freedom to access space. In other words, agreements that prohibit the physical destruction of satellites—debris-creating engagements like China's demonstration in 2007—and are designed to preserve international access to space warrant careful consideration. When asked to comment on the destruction of China's *Feng Yun* weather satellite, Heiner Klinkrad, head of the European Space Agency's (ESA) space debris office in Darmstadt, Germany, said that "destroying a satellite at this altitude, in sun-synchronous orbit, presents a debris problem about as serious as you can get" and speculated that some debris could remain on orbit for hundreds of years.[41] The Chinese demonstration raised the issue of space debris to a grand-strategic level, leading a US State Department spokesman to note, "We don't believe anyone should be doing these kinds of activities."[42] Again, preventing the *deployment* of such weapons would be pointless, given the dual-use phenomenon of space-based missile defense systems. However, banning the

physical destruction of any nation's satellites, through either testing or hostile acts, might represent a reasonable starting point for negotiators in Geneva.

Assuming the United States is unwilling to compromise on its commitment to missile defense, most space weapons treaty proposals fall well short on feasibility. However, Moltz, a national security affairs professor at the Naval Postgraduate School, has put forth a construct that warrants thoughtful consideration. His five-point proposal is as follows:

- No use, testing, or deployment of weapons or interceptors of any sort in regions of space above 500 miles;
- Permitted testing of ground-based, sea-based, and air-based interceptors in low-Earth orbit (60–500 miles) against ballistic missiles passing through space (although with frequency limitations per year/per state and possible restrictions on altitude and debris generation, which do not exist today);
- No stationing of weapons of any sort in low-Earth orbit, including kinetic-kill vehicles, lasers, or any other weapons for use against space-, ground-, sea-, or air-based targets (to prevent destabilizing aspects of short warning times in space and to alleviate public fears of use of weapons from space against cities);
- No testing or use of lasers from ground-, sea-, or air-based platforms against any space-based, orbital objects; and
- No testing or use of other ground-, sea-, or air-based weapons against satellites or other space-based objects (chiefly a confidence-building and debris-reduction measure, because direct-ascent missile defenses would have some residual ASAT capabilities).[43]

Moltz effectively preserves the essential elements of missile defense while banning specific ASAT effects. However, any generic ban on weapons first requires one to define exactly what is meant by *weapon,* which is exceedingly difficult. A micro- or nanosatellite, placed on orbit to provide a modest communications capability, becomes a weapon when its final thruster burn sends it on a collision course with a larger spacecraft. Virtually anything in orbit could perform the function of a space weapon. Allegedly, the Soviet Union applied this same logic to stall US efforts to finalize an ASAT treaty in the late 1970s, when it insisted on classifying the US space shuttle as a potential ASAT weapon.[44]

There is another fundamental reason why Moltz's proposal, like the Chinese proposal discussed earlier, to ban the *use* of space weapons is futile. The concept sounds good in theory but

is completely impractical in every other sense. Why stop at ASATs? This line of logic, if pursued, supports a ban on any platform of war. Consequently, nations ought to ban attacks on aircraft, ships, and tanks. Of course, why stop there when a ban on warfare would solve many more problems—a line of reasoning which borders on hysteria. Indeed, many held this view in the years succeeding the First World War. British historian E. H. Carr once remarked that "the utopian assumption that there is a world interest in peace which is identifiable with the interest of each individual nation helped politicians and political writers everywhere to *evade the unpalatable fact* of a fundamental divergence of interest between nations desirous of maintaining the *status quo* and nations desirous of changing it."[45] (emphasis added) This problem underscores a larger, more general predicament regarding the concept of space arms control. It is no more plausible to attempt to guarantee security in space than it is to attempt to guarantee security anywhere on earth. John Sheldon, a space policy expert at Air University's School of Advanced Air and Space Studies, summarizes the point succinctly, "If a country relies on satellites for the effective use and projection of military force terrestrially, on what basis is it realistically possible that the very satellites that enhance and support military force can be exempt from the actions of an enemy?"[46]

Confidence-Building Measures

While some members of Congress urgently called for new legal treaties in the aftermath of the Chinese ASAT debacle, others noted the need for "common norms and acceptable rules of behavior in space," also known as *confidence-building measures*.[47] Confidence-building measures that delineate rules of the road or responsible space-faring behavior are not typically binding—an attribute that distinguishes them from legal instruments such as treaties. Nonetheless, they offer a useful construct through which representatives can share and debate ideas. In some cases, diplomats can later incorporate these tools into useful legal instruments. Confidence-building legal measures include the Registration Convention of 1976, the Liability Convention of 1972, and the

Rescue Agreement of 1968.[48] Joanne Gabrynowicz, director of the National Center for Remote Sensing and a law professor at the University of Mississippi, argues that the form and legal status of international agreements are not the most salient points. She observes that "one of the things we've seen since the end of World War II is a proliferation of different kinds of agreements—resolutions, memorandums of understanding, charters, codes of conduct, all in addition to treaties—and the significance of that is not whether or when they become legally binding but rather that this is political will manifesting. . . . If we only focus on the form in which this political will is manifesting . . . we are losing sight of what we need to be seeing."[49] The logic behind confidence-building measures is to establish universally recognized international norms about the rights and responsibilities of space-faring nations, a discussion some believe the United States has failed to engage with China.[50] A few areas are worthy of consideration.

Debris Mitigation

The continued progress of the Inter-Agency Space Debris Coordination Committee (IADC) is critical to the establishment of an international norm regarding the employment of debris mitigation practices. The agency is comprised of representatives from the civilian space agencies of 11 member nations, including the China National Space Administration and NASA. In 2004 the IADC published a set of guidelines designed to encourage space-faring nations to implement debris-mitigating practices into the design and operation of spacecraft. The next step is to codify such guidelines by strengthening the Convention for International Liability for Damage Caused by Space Objects. In this way, individual nations would be accountable for any damage caused by their debris, which may serve to discourage future testing of the destructive nature demonstrated in 2007. Of course, the United States and Russia would likely seek grandfather clauses, as the majority of catalogued space debris is a result of their collective space activities between 1966 and 1996.[51]

Escalation Control

Rules of engagement (ROE) have always been a critical component of escalation control. Gen Douglas MacArthur was told to stay away from the Yalu.[52] Gen John McConnell was told he could not bomb Hanoi.[53] Political leaders and military commanders use ROEs to ensure hostilities do not provoke an undesirable response. During the height of the Cold War, both Russia and the United States understood that any attempts to blind the opponent's early-warning systems would immediately constitute an act of war, more specifically, a nuclear attack, since the blinded party would have no means to verify that an attack was not underway. Consequently, the prohibition of interference with national technical means was captured in a variety of treaties and agreements, such as the 1972 Anti-Ballistic Missile Treaty, the 1987 Intermediate Nuclear Forces Treaty, and the 1991 Strategic Arms Reduction Treaty.

Today, the ROEs that govern space hostilities are nonexistent. No agreements, formal or informal, regarding the interference or denial of space capabilities have been negotiated. Moreover, the United States has not clearly articulated a policy describing exactly how it would react to an attack on a US spacecraft. Some US officials have indicated that such an attack would constitute an act of war.[54] During congressional hearings, Maj Gen James Armor, USAF, retired, then director of the National Security Space Office, offered a more measured approach borrowed directly from national space policy: "The United States views purposeful interference with its space systems as an infringement on its rights and will take actions necessary to preserve its rights, capabilities, and freedom of action in space including denying, if necessary, adversaries the use of space capabilities hostile to US national interests."[55] The phrase "will take actions necessary" is too ambiguous to constitute a declaratory policy.

The point became more evident in March of 2007, just weeks after China's ASAT test, when General Cartwright mused, "How many satellites would [the United States] be willing to lose before we went to a nuclear alternative?"[56] Cartwright's query raises another point. If the Second Artillery Corps becomes operationally responsible for China's ASAT capability, is it possible a missile strike against a Chinese ground-based ASAT system will in-

advertently threaten China's nuclear command and control element?[57] Again, the issue of escalation control is unclear.

A historical review does little to add clarity. In 2003 a satellite jammer transmitting from Cuba effectively blocked US government Voice of America broadcasts into Iran. The United States launched an investigation while a US State Department spokesman commented, "We are looking into the source of interference of these broadcasts and we'll be taking up with the Cubans the question of whether or not this interference is coming from Cuba."[58] Since Voice of America is not a valuable military asset, the modest response offered by the United States was probably appropriate. However, when China dazzled a US imaging satellite in 2006, National Reconnaissance Office (NRO) director Donald Kerr downplayed the incident, acknowledging that something had happened but that "it did not materially damage the US satellite's ability to collect information."[59] How did China know the United States would react so indifferently?

Space ROEs could take many forms. Experts at the Massachusetts Institute of Technology Lincoln Labs have proposed one possible model (see table).[60]

Table. Notional space rules of engagement defining hostile intent/hostile acts

Threat	*Hostile Intent*	*Hostile Act*
Collision between on-orbit assets	Preparation to deliberately maneuver toward asset with a high probability of collision	Deliberate collision with hard-kill effects
Co-orbital microsat	Deliberate penetration of the stand-off distance/exclusion zone; nondestructive interference with operations	Deliberate penetration of engagement zone; destructive interference with operations
Reentry over US territory or forces	Preparation to deliberately deorbit	Deliberate deorbit with hard-kill effects
Direct ascent ASAT	Preparation to launch by fueling the missile on the launch pad	Launch
Ground-based laser	Placing a target designator on the satellite	Initiating a firing sequence

Reprinted from Aaron J. Seltzer, "An Introduction to Orbital Dynamics: How Physics Affects the Use of Space" (lecture, Naval War College, Newport, RI, 7 March 2007).

Nevertheless, difficulties quickly arise when one applies traditional, terrestrial-based logic to the space environment. Proximity and maneuver take on a completely new meaning in space. For example, a 65-kilometer exclusion zone appears reasonable;

however, currently 40 percent of the spacecraft in geosynchronous orbit has at least one encounter of 65 kilometers or less every year. Furthermore, satellites in low-earth orbit separated by several hundred kilometers can still rendezvous in less than 45 minutes.[61] Reaching international consensus may not be easy; nonetheless, the discussion would be valuable.

Escalation control is a confidence-building measure whose time has come. The commander of Air Force Space Command, Gen C. Robert Kehler, argues that "during the Cold War we, through a number of our actions, made it very clear what our policies meant to us. That helped our potential adversaries determine what [our] redlines really were. I think we have a lot of work to do [in this area]."[62] Internationally debated and agreed-upon space rules of engagement for defining hostile intent and hostile acts would resolve the ambiguity that currently clouds the issue. More importantly, they could serve as a deterrent to nations such as China, which might otherwise be tempted to experiment on US satellites.

Summary

The vertical disharmony in US foreign policy toward China has been one source of the distrust that continues to handicap relations across the Pacific Ocean. The *U.S. National Space Policy* has failed to grasp the soft-power attributes of space, resulting in a poorly implemented unilateral approach toward national security space strategy. New policies that embrace the advantages of an international security space alliance can successfully address the challenges of space as a contested environment. A new paradigm has emerged.

Treaties will continue to be problematic for the United States vis-à-vis the international space community. As a hegemonic space power, the United States cannot afford to negotiate treaties that will adversely impact its own national security posture, nor does any nation realistically expect it to do so. However, important dialogues about the conduct and norms of space-faring nations must continue, and diplomats are right to codify these manifestations of political will for the benefit of the international space community. All nations want to preserve

the use of space for future generations, and the United States must find a way to lead such an effort. Furthermore, every nation must understand the implications of space interference and the redlines that govern such behavior. Failure to establish escalation-limiting mechanisms serves as a precursor to unintended and unnecessary military conflict.

Notes

1. Feffer, "China: What's the Big Mystery?"
2. DOD, *Report of the 2006 Quadrennial Defense Review*, 29.
3. DOD, *Annual Report to Congress*, 2007, I.
4. Freedman, *Deterrence*, 11.
5. Nye, *Soft Power*, x. Joseph S. Nye Jr., former dean of the Kennedy School of Government at Harvard University, was chairman of the National Intelligence Council and an assistant secretary of defense in the Clinton administration.
6. DOD, *Annual Report to Congress*, 2007, 7.
7. Glaser, "Ensuring the 'Go Ahead' Policy."
8. Tellis, "Sustaining China's Rise: Obstacles and Risks."
9. Pew Global Attitudes Project, *American Character Gets Mixed Reviews*, 2.
10. Worden, address.
11. Johnson-Freese, *Space as a Strategic Asset*, 234–35. For example, Dr. Freese points out one objectionable line: "In this new century, those who effectively utilize space will enjoy added prosperity and security and will hold a substantial advantage over those who do not" (ibid.). This statement is too easily misconstrued to mean *military advantage*, in which case one might conclude that the United States plans to deter other nations from gaining access to space.
12. Executive Office of the President, *U.S. National Space Policy*.
13. DOD, *Report of the 2006 Quadrennial Defense Review*, ix.
14. von Bencke, *Politics of Space*, 101–4.
15. Moorman, address.
16. Lowe, "AF Sec Calls China Sat Kill an 'Egregious Act.'"
17. Hitchens, "US-Sino Relations in Space," 21.
18. Since November 2003, Japan has launched four civil-military surveillance satellites (two electro-optical and two radar); Taiwan's single *FormoSat-2* (electro-optical with a two-meter resolution) has been flying since May 2005; South Korea's *Koreasat-5*, launched on 22 August 2006, provides imagery to civil and military users; India now maintains three high-resolution imaging (electro-optical satellites) and is developing a radar satellite. Its latest one-meter resolution *Cartosat-2* was launched on 10 January, one day before China's ASAT test. Fisher, "Space to Manoeuvre."
19. Jervis, *Perception and Misperception*, 111.
20. de Selding, "Canada to Help US Monitor Space."
21. Wirbel, "Space-Control Philosophy."

22. The ideas in this paragraph can be attributed to Amb. Claudio Bisogniero. See Bisogniero, address.
23. Roberts, "Lost Connection."
24. Ibid.
25. "North Atlantic Treaty."
26. Butler, "Bush Memo Orders Space Situational Awareness."
27. Freece, "Bees, Not Bears," 12.
28. UN Office at Geneva, "Conference on Disarmament."
29. Ibid.
30. Quoted in Hagt, "China's ASAT Test."
31. Crawley, "US Encourages Responsible Behavior."
32. Flak cannons were employed by the Nazis in the Second World War as an air defense system.
33. Glossop, *Confronting War*, 236.
34. Mulrine, "Behind the Scenes."
35. Harrington, "US Reserves Right."
36. "Shelton: Space Warfare Is Certain."
37. Krepon, "Will the Bush Administration Endorse?"
38. The United States based its decision to withdraw from the Anti-Ballistic Missile (ABM) treaty on the realization that there is currently no means of stopping a ballistic missile traveling through space. Moltz, "Breaking the Deadlock."
39. Ibid. Hui Zhang observes that "the 1967 Outer Space Treaty, now involving 120 states, bans nuclear weapons or any other weapons of mass destruction in space or on the moon and other celestial bodies, but does not ban weapons in general. The 1963 Limited Test-Ban Treaty and the 1996 Comprehensive Test-Ban Treaty prohibited nuclear test explosions in space. The 1979 Strategic Arms Limitations Talks (SALT II) banned the development, testing, and deployment of systems for placing nuclear weapons or any other weapons of mass destruction, including fractional orbital missiles, into Earth orbit. The 1972 ABM treaty prohibited the development, testing, or deployment of space-based missile defense systems or components. Until the United States' withdrawal, the ABM treaty had been one of the most important agreements on the prevention of space weaponization. It remains apparent that, with or without the ABM treaty, existing treaties are not sufficient to restrict the weaponization of outer space." Podvig and Zhang, *Russian and Chinese Responses*, 69.
40. Delegations of China, The Russian Federation, Vietnam, Indonesia, Belarus, Zimbabwe, and Syrian Arab Republic, "Possible Elements for a Future International Legal Agreement," 3.
41. de Selding, "Debris from FY-1C."
42. de Selding, "China Says It Remains Opposed." The apparent hypocrisy of such statements was not lost on the Chinese in the aftermath of the February 2008 shootdown of a crippled National Reconnaissance Office (NRO) satellite. See "Who's the Hypocrite?"
43. Moltz, "Breaking the Deadlock."
44. Karas, *Implication of Space Technology*, 17.
45. Carr, *Twenty Years' Crisis,* 53.

46. Sheldon, "There's No Such Thing as Space Security."

47. Comment attributed to Rep. Ellen O. Tauscher (D-CA), chairman, House Armed Services Strategic Forces Subcommittee. Gertz, "US Halts China Space Ventures."

48. Article 4 of the Registration Convention provides that the launching state should furnish to the

> United Nations, as soon as practicable, the following information concerning each space object . . . : (a) name of launching State or States; (b) an appropriate designator of the space object or its registration number; (c) date and territory or location of launch; (d) basic orbital parameters, including: (i) nodal period [the time between two successive northbound crossings of the equator—usually in minutes], (ii) inclination [inclination of the orbit—polar orbit is 90 degrees and equatorial orbit is 0 degrees], (iii) apogee [highest altitude above the Earth's surface—in kilometers], [and] (iv) perigee [lowest altitude above the Earth's surface—in kilometers]; [and] (e) general function of the space object.

UN General Assembly, Resolution 3235, "Convention on the Registration of Objects."

Elaborating on Article 7 of the Outer Space Treaty, Article 2 of the Liability Convention provides that "a launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft flight" and liable for damage due to its faults in space. The convention also provides for procedures for the settlement of claims for damages. UN General Assembly Resolution 2777, "Convention on International Liability."

The Rescue Agreement, elaborating on elements of Articles 5 and 8 of the Outer Space Treaty, provides that "States shall take all possible steps to rescue and assist astronauts in distress and promptly return them to the launching State, and that States shall, upon request, provide assistance to launching States in recovering space objects that return to Earth outside the territory of the Launching State." UN General Assembly Resolution 2345, "Agreement on the Rescue of Astronauts."

49. Gabrynowicz, address.

50. Larry Wortzel suggests, for example, that US and Chinese officials have never discussed important issues such as the interference of a sovereign nation's spacecraft. Numerous discussions with the Russians over national technical means resulted in an agreement prohibiting such interference. Wortzel, address.

51. National Science and Technology Council, *Interagency Report on Orbital Debris*, 10.

52. Cohen and Gooch, *Military Misfortunes*, 170–71.

53. Gelb and Betts, *Irony of Vietnam*, 136–37.

54. Saunders and Lutes, "China's ASAT Test."

55. "Pentagon Reaffirms US Right."

56. To provide context, General Cartwright was supporting his case to build an array of conventional missiles with a global range capable of striking urgent targets, such as an ASAT missile on a launchpad, within 60 minutes of an

order to attack. Currently, the only weapons available to reach targets deep inside the territorial boundaries of a country the size of China are nuclear intercontinental ballistic missiles. Gertz, "China Has Gained and Tested."

57. The Second Artillery was likely involved with (or at least observed) the execution of the test, although the extent of its involvement is unknown. Experts who study China's nuclear forces generally concur that if the system transitions from the research and development community into the operational community, the Second Artillery has a very good chance of assuming responsibilities for its operational employment. Dr. Michael Chase (professor, Strategy and Policy Department, Naval War College), interview by the author, Naval War College, Newport, RI, 30 March 2007. Chase has published numerous articles on Chinese nuclear strategy and the Second Artillery. Also, see references to other Chinese political and military experts who believe the Second Artillery participated in the test in Sanger and Kahn, "U.S. Officials Try to Interpret"; and Saunders and Lutes, "China's ASAT Test."

58. "US Broadcasts 'Jammed by Cuba.'"

59. Shalal-Esa, "China Jamming Test."

60. Seltzer, "Introduction to Orbital Dynamics."

61. Ibid.

62. Kehler, address.

Chapter 4

Information Dimension

> *The United States maintains a large investment in satellites and this investment has grown dramatically in recent years. . . . At the same time, our investment in intelligence collection concerning threats to our interests in space has declined markedly in relation to our overall investment in space systems.*
>
> —Senate Select Committee on Intelligence, Report 110-75 110th Cong., 1st sess., 2007

Response Option: America must rely on information superiority to counter China's burgeoning military space capabilities. Externally, America must foster an international pressure demanding greater transparency vis-à-vis China's military modernization efforts. Internally, reforms to space intelligence will ensure the United States can meet future requirements in a rapidly expanding domain of warfare.

In modern times, information power is generally considered the most compelling instrument of national power. Theoretical ideas regarding the speed and maneuver of information have preconditioned the US military to embrace a transformation to network-centric warfare. Likewise, the PLA has undergone its own revolution in military affairs based on the precepts of informationized warfare. Still, neither the United States nor China is seemingly able to discern the intentions of the other, and their respective need for information appears insatiable. Western diplomats characterize this phenomenon as transparency, while military commanders refer to it as intelligence. Both are critical elements of information as an instrument of national power, and both offer options for a US response to Chinese space weapons.

Transparency

Nearly every American scholar, analyst, or strategist who comments on the state of affairs in China is obliged to broach the

issue of transparency. At the most fundamental level, transparency is information sharing. It is the level of insight available to outsiders about internal processes, and it is immensely important in Western ideals. Consequently, US citizens demand a high level of transparency within their government. For example, congressional activities are a matter of public record; the Freedom of Information Act carries a presumption of disclosure; one critical element of the US Constitution's First Amendment is the guarantee of press freedom, which protects the processes for obtaining information for public distribution.

From the Western perspective, transparency generally deters corruption. The US Securities and Exchange Commission standards of transparency for publicly traded companies derive from a simple and straightforward concept, that "all investors, whether large institutions or private individuals, should have access to certain basic facts about an investment prior to buying it, and so long as they hold it."[1] Generally, Americans believe such transparency is required—a less than subtle nod to Machiavelli's assertion that man is "readier for evil than for good."[2] The Enron scandal of 2001 makes the point aptly.

The Chinese Perspective

The extent to which other nations around the world, notably China, embrace the tenets of transparency varies widely. Historically, the Chinese Communist Party led a military struggle that began with seizing control of a national regime and that has since progressed to consolidating the national regime, safeguarding the national security, and preserving and consolidating sovereignty.[3] A timeless attribute of Chinese strategy, and one embraced obsessively by the CCP, is secrecy. Although China's military modernization is in full stride, the PLA has not yet abandoned its asymmetrical approach of gaining the initiative by striking first. Mark Stokes, the former country director for the PRC and Taiwan within the Office of the Secretary of Defense, International Security Affairs, asserts that from a Chinese perspective, asymmetrical strategies are "an effective means to offset technological and logistical advantages which a more advanced military power brings to the fight."[4] Such an approach depends on a high degree of disinformation, decep-

tion, and secrecy. Chinese scholars Zhu Mingzhuan and Bo Yan add that secrecy "is essential to the security of weaker states, who [*sic*] must rely on ambiguity to create sufficient doubt in the minds of stronger rivals who would take unfair tactical advantage of information that detailed the specific nature and extent of their acknowledged relative weaknesses."[5] Secrecy (the antithesis of transparency) has enabled the authoritarian regime to retain control, both internally and externally, since its rise to power in 1949.

Chinese leaders have come to accept that greater transparency is required to integrate successfully with the international establishment. Trade globalization, the underpinning of China's economic success and consequent modernization, requires a significant degree of transparency to reassure foreign investors. Furthermore, Chinese political leaders have made accommodations in the conduct of their international security policy. One analyst notes that "they joined the International Atomic Energy Association in 1984, acceded to the Non-Proliferation Treaty in 1992, and joined the Zangger Committee in 1997. All of these commitments required the surrender of highly protected information to international authorities."[6] PLA commanders also claim a desire to be more transparent. Lt Gen Zhang Qinsheng, deputy chief of the PLA General Staff, cites the release of five white papers on national defense as an example. Zhang claims that "the Chinese army is taking pro-active and pragmatic measures to improve transparency of national defense."[7] US analysts, however, are looking for a different level of transparency—one that provides substantial details of crucial defense issues that might prove helpful in understanding the processes of the Chinese defense sector, more so than the political rhetoric that typifies a white paper.[8]

The ASAT test has placed an increased sense of urgency on the part of US leaders to seek and achieve a level of transparency with China that can mollify heightened US threat perceptions. Defense analysts William Martel and Toshi Yoshihara suggest that such a task is exceptionally difficult in that both Washington and Beijing "cloak their space programs in extraordinary levels of secrecy." They add that "each side probably believes that maintaining great uncertainty in the minds of potential adversaries enhances their security. China shields its

space program from scrutiny to hide its relatively inferior position; the United States does so to maintain its technological lead. This culture of secrecy creates an impediment to enhancing mutual understanding about the other's intentions."[9] Although US officials routinely imply China should embrace the same level of transparency demonstrated by the United States, it is unlikely US leaders would then be satisfied. Peter Hays, a space analyst at the US National Security Space Office, suggests the United States must better articulate its own intentions vis-à-vis space. Like many critics of the 2006 US National Space Policy, he argues the policy lacks transparency and blames the administration for doing a "[poor] job of preparing the field to roll [the] report out."[10] One might conclude that an "all around" lack of transparency, or at least trust, has progressively exacerbated the issue.

Increasing Transparency

What can be done to improve transparency between China and the United States? Amb. Roger Harrison argues that the first step is for US diplomats to choose a different word. In Mandarin, the English word *transparency* translates with an indication of espionage. Harrison contends that "precision of language is critically important" when communicating Western ideals to Chinese representatives.[11] As a result, he has led an effort at the Eisenhower Center for Space and Defense Studies to develop a space strategic lexicon designed to improve clarity of communication with Chinese officials.

Martel and Yoshihara suggest that transparency requires additional key steps, including military-to-military contacts and broader exchanges of information.[12] Indeed, military-to-military represents one area where further efforts may yield progress. At the general-officer level, US commanders have made a host of visits to Beijing since 11 January 2007.[13] Although the United States has been unable to discern the details of China's intentions regarding the deployment of ASAT weapons, the meetings have led to discussions about other ways to increase transparency, such as establishing a military hotline between the United States and China in cases of emergency.[14] In his testimony to Congress, Richard Lawless, deputy under secretary of defense

for Asian and Pacific security affairs, said, "We believe these exchanges and mechanisms have the potential to improve mutual understanding, reduce miscalculation, and contribute, over time, to 'demystifying' one another."[15]

However, it is unlikely the United States will achieve a significant level of insight by flying into Beijing and simply asking for transparency. That dialogue is important, but the Chinese culture places an emphasis on "developing human relationships, building mutual trust, and establishing a stable interpersonal foundation for long-term cooperation."[16] With this formula, transparency develops over time, through continued interaction. The imperative for the United States is to remain engaged in multiple levels of dialogue. To isolate China every time ripples in the security environment shake US confidence is counterproductive. For example, the US decision to suspend plans to develop space ventures with China, including joint exploration of the moon, in reaction to Beijing's 11 January ASAT test effectively negates any potential for strengthening relationships that could eventually lead to greater transparency.[17] Likewise, speculation that the United States should have boycotted the 2008 Olympic Games in Beijing in objection to China's harsh crackdown against Tibetan separatists represents the "carrot and stick" approach to diplomacy that has done little to increase transparency in previous decades.[18]

Given the measured success of high-level talks, the United States should explore the benefits of increased military-to-military contact throughout lower levels of the armed forces. A 2000 Air Force–directed program designed to improve bilateral military-to-military relations and build partnership capacity has grown with promising potential. The program fosters exchanges with foreign militaries at the staff, operator, and general-officer levels. However, China is not yet among the list of nations with which the Air Staff plans to visit, an oversight the Pentagon must correct if it hopes to gain greater insight into PLA processes.[19] In addition, the United States should formalize a military student-exchange program with the PLA. Other foreign military officers that attend US war colleges usually return to their native countries to resume immensely successful careers. The relationships they forge in the United States as midranking officers are ones they carry forward. Often, such officers ascend in rank to the very pinnacle of their respective services. Strong ties

between Chinese and US flag officers that date back 10–15 years would prove to be extraordinarily beneficial in cooling heightened threat perceptions and misunderstandings. Furthermore, modest joint military exercises offer an opportunity for additional collaboration across various ranks of Chinese and US armed forces. Initial exercises could focus on relatively benign military tasks such as search and rescue, humanitarian missions, or disaster relief. China's ability to contribute substantially in such areas benefits the United States in multiple ways and could be the objective of joint training that continues to strengthen mutual understanding and insight.

Space Intelligence

What one fails to discern through transparency, one must ascertain through intelligence. The initial reaction of many analysts seems to be that China's 2007 ASAT test took America by surprise. Two days after the story broke, the *Washington Post* was quick to print that "the day the test was conducted, the chiefs of major US intelligence agencies presented their annual threat assessments to Congress. Neither China's anti-satellite program nor its general push toward space weapons was mentioned during the public hearing or anywhere in the written testimonies of the director of national intelligence, the director of the Pentagon's intelligence agency or the CIA [Central Intelligence Agency] director."[20] Ironically, both the CIA and the NRO admit space-based reconnaissance is not the most effective way to monitor Chinese space weapons development given China's adept use of camouflage.[21] The NRO's director, Donald Kerr, said there is a lack of "good intelligence" on what other nations are doing in space. US analysis capability of space threats has "diminished substantially" following cutbacks after the fall of the Soviet Union in 1991.[22]

The Senate Select Committee on Intelligence wasted little time in drafting legislation to reform, yet again, the intelligence community. This time, the amendment would create a new national space intelligence office within the Office of the Director of National Intelligence (DNI). According to the proposal, the new office would provide policy direction, prioritize space-related col-

lection, and evaluate assessments of threats.[23] The Senate proposal was predictable. One of the main provisions of the last intelligence reform act was the establishment of a National Counterterrorism Center, responsible for commensurate tasks.[24] However, it is not clear to everyone that 11 January 2007 represented an intelligence failure. Furthermore, despite whatever deficiencies might exist within the space intelligence discipline, the DNI did not agree that an organizational face-lift was the correct solution.[25]

Arguably, the Intelligence Reform Act of 2004 has improved information sharing throughout the intelligence community. Still, *if* the intelligence community indeed failed to anticipate China's efforts to develop and test a space weapon, Thomas Mahnken offers possible reasons in his book *Uncovering Ways of War.* Mahnken examines why intelligence organizations often fail to detect the development of innovative technology and derives three conclusions: (1) intelligence agencies are more inclined to monitor the development of established weapons than to search for new military systems, (2) intelligence agencies pay more attention to technology and doctrine that have been demonstrated in war than to those that have not seen combat, and (3) it is easier to identify innovation in areas that one's own services are exploring than those they have not examined, are not interested in, or have rejected.[26] Moreover, weapon systems produced on a small scale or developed to meet a unique operational requirement, such as ASAT weaponry, pose a particular challenge to intelligence services.[27]

In actuality, of all the US intelligence problems exposed by China's edgy demonstration, a *failure to predict the test was not one*. By 2007 the intelligence community was fully aware of China's efforts to develop and test an ASAT missile. Earlier attempts, all failures, had cued intelligence assets, many of which deployed to various locations to collect as much information as possible. Imagery had revealed the exact location of the mobile missile launcher used in the test weeks before the 11 January launch.[28] Furthermore, the United States had deduced the most likely target and the exact launch window. For years, the AFSPC space surveillance network reported the FY-1C orbital elements with a frequency of once or twice daily, but those reports jumped to about four times per day just before the test.[29]

In the hour just prior to the intercept, the SSN measured the target's element set six times.[30] Despite the preponderance of early reports suggesting China's ASAT test took America by surprise, the evidence indicates that the intelligence community not only anticipated the event but was well postured to collect valuable intelligence throughout the day.

Intelligence Deficiencies and Options

This begs the question, what is the real deficiency in national security space intelligence? Perhaps a better way to approach the issue is to consider what changes could better prepare the US intelligence apparatus to meet the emerging requirements of space operations. There are several options. The first reflects the shrinking capacity of the intelligence community since the 1990s. While recent intelligence reforms have reversed some of these trends, space intelligence requirements are emerging at an increasing rate. The Senate report that accompanied its proposed legislation noted, "The United States maintains a large investment in satellites and this investment has grown dramatically in recent years. At the same time, our investment in intelligence collection concerning threats to our interests in space has declined markedly in relation to our overall investment in space systems."[31] Senior military commanders agree. At a 2007 space conference, Maj Gen William Shelton expressed dissatisfaction regarding the number of space intelligence analysts available to aid military decision makers in understanding what capabilities potential adversaries possess and what they intend to do with them.[32] China is particularly problematic. Space analysts at the National Air and Space Intelligence Center (NASIC) admit they know virtually nothing about China's military space doctrine, although they are certain one exists.[33]

One option is to increase efforts to exploit open-source intelligence methods. The US Navy recently formed a dedicated open-source center for the study of Chinese maritime power. The China Maritime Studies Institute (CMSI) employs approximately 10 Mandarin linguists who conduct research, publish articles, host conferences, provide congressional testimony, and conduct scholarly exchanges at prestigious Chinese institutions such as

Qinghua University and Beijing University.[34] The CMSI has formed a complementary relationship with the Office of Naval Intelligence, the Navy's traditional intelligence organization.

No similar organization exists to support the NASIC or its parent organization, the Air Intelligence Agency (AIA). The task of penetrating Chinese intentions in space may be the type of problem best solved by integrating open- and traditional-source intelligence. One NASIC analyst suggests there may be some value in comparing open-source publications regarding Chinese space doctrine to what China is actually doing in space (in terms of the type of space assets—hardware and software—China is acquiring). The merger of such analyses could offer fruitful insight as to what China hopes to accomplish in the military space domain.[35]

The argument that the intelligence community needs greater resources is somewhat trite. Appropriation levels for intelligence will never be adequate in the eyes of commanders depending on answers to tough strategic questions. Intelligence is an imperfect science—as a result, more analysis is usually better. The more difficult question is one of roles, responsibilities, and prioritization. As the nation focuses the preponderance of its resources on fighting global terrorism, episodic events such as China's ASAT test are reminders that other actors continue to shape the strategic security environment. The director of national intelligence, since its creation, is largely responsible for working with the secretary of defense in balancing priorities across the full spectrum of intelligence efforts.[36] The need for a greater emphasis on space activities is an easy argument to make. In 2008 only 1 percent of NASIC's discretionary budget was dedicated to space.[37] China's test should raise questions within the Air Force as to how it might best prioritize resources. To suggest, however, that the DNI should reprioritize assets away from counterterrorism to meet the growing space requirement is a more contentious assertion to support.

China's ASAT test did prompt the Defense Intelligence Agency (DIA) to lead a review of roles and responsibilities among government agencies on the subject of counterspace.[38] Interestingly, the requirements to support US space operations during an ASAT launch fall along the indistinct line between strategic and tactical intelligence. A RAND report on intelligence reform notes, "As the capabilities of 'national' collection systems in the

NIP [National Intelligence Program] have improved, they have become increasingly important to warfighters for tactical purposes, and thus the distinction between 'strategic' and 'tactical' has blurred."[39] China's space weapons test made this point abundantly clear to US space commanders.

The Joint Space Operations Center (JSPOC) at Vandenberg AFB, California, serves as both the fusion center and command and control element for joint space operations. Like any operations center, the JSPOC relies on the timely processing and transfer of information to perform its mission. Lt Gen Michael Short, USAF, retired, suggests it is among the most critical tasks in an operations center. While discussing the time he served as the combined force air component commander during Kosovo operations in 1998, the general recalled, "The first thing I said when I walked into the AOC [Air Operations Center] was 'I'd like to see your information management plan.' I then needed several hours to sit down and go through it to understand how information flows [throughout the center]."[40] However successful the JSPOC's accomplishments on 11 January 2007 may have been, the effective and efficient free flow of information between various organizations required a full panoply of improvised mechanisms. JSPOC controllers on duty during China's ASAT test overcame significant hurdles, including immature procedures, unclear organizational roles and responsibilities, and multilevel classification barriers. At the end of the day, the team achieved mission success but also confirmed that future operations in the contested environment of space will require dynamic processing tools and well-established organizational procedures and relationships.[41]

The US national security space program has long been a collection of stovepiped organizations encumbered by institutional and bureaucratic barriers. The measures implemented by Defense Secretary Donald Rumsfeld in May 2001 aimed at creating "a new and comprehensive national security space management and organizational approach" to promote and protect US interests in space.[42] These measures have had a relatively positive impact on national security space. Significant improvements in the integration of national intelligence products have enhanced joint war-fighting effectiveness and collaboration across multiple stakeholders. Much of the progress was the result of the

singular vision of Under Secretary of the Air Force (USECAF) Peter B. Teets, who also assumed directorship over the NRO—a result of the Space Commission's recommendation to merge the two positions. However, continued consolidation under the umbrella of a single national security space enterprise became doubtful when the DNI later convinced the secretary of defense to abandon the dual-hatted approach.[43] As an additional strain, Secretary Rumsfeld granted the NRO directorship, traditionally held by an Air Force official, to a CIA veteran, Donald M. Kerr. That change had a seemingly greater impact on the fate of the consolidated space enterprise than did the dissolution of a unified authority, as many within the Air Force space community perceived the two organizations would consequently drift apart. "When people define situations as real, they are real in their consequences," observed social psychologist W. I. Thomas.[44] In the end, a self-fulfilling prophesy emerges.

Those in Congress who opposed these changes warned that a "weakened role and the ensuing lack of senior Air Force advocacy within and for the NRO will force a decline in the number and quality of the Air Force personnel assigned to the NRO."[45] Secretary Wynne, more concerned with the flow of information between the individual organizations, observed, "We know Don Kerr does great work; we know that the NRO does great work; we know that the Air Force does great work. . . . [The question remains,] how do we share, and [what] are the roles and missions?"[46] Wynne's concerns struck at the heart of the issue. Organizational behaviorist Gareth Morgan suggests that "many aspects of organizational structure, especially hierarchy and departmental divisions, influence how information flows. Often, the quest for control of information in an organization is linked to questions of organizational structure."[47]

The changes in leadership at the NRO and USECAF (space) may have widened the fracture within the national security space enterprise. Key stakeholders, including the USECAF; the NRO director; the defense under secretaries for intelligence, policy, acquisition, technology, and logistics; and the assistant defense secretary for networks and information integration play critical roles in the progression of a comprehensive space strategy that includes space protection. Yet the roles and responsibilities of each organization remain poorly defined.

Mr. Teets, when recently asked if a single office should once again lead the space activities of both the NRO and the Air Force, replied, "Absolutely, it's the right thing to do. It is vitally important that one person have the lead on national security space. This country needs one DoD executive agent for space."[48]

Summary

The vertical disharmony apparent in US efforts to increase PLA transparency is both a function and product of the sense of urgency with which American statesmen pursue the task. Transparency, from the Chinese perspective, runs contrary to cultural and political norms. The pervasive secrecy that shrouds specific operational details of space activities in both countries will not disappear soon. However, modest gains in transparency are possible over time with increased and broadened military-to-military contact throughout the PLA and US armed forces. Operations-to-operations programs, military student exchanges, and more frequent bilateral military exercises are possible options.

The military was prepared for China's ASAT test, but the event revealed both structural and contextual deficiencies in America's space intelligence capacity. Structurally, the leadership, roles, and responsibilities of key organizations must align to support one national security space enterprise. The DIA-led review is a good start, but the scope of this effort is probably beyond the purview of an organization at this level. A greater review of the roles and responsibilities of all national security space stakeholders is overdue. Furthermore, the new DNI structure raises questions about national security space processes and priorities. Could a new national space intelligence office within the DNI address these issues, as the Senate proposal suggested? Perhaps it could. However, the codification of roles, responsibilities, and priorities would likely accomplish the same without the creation of another bureaucratic layer in the enterprise.

Contextually, the advent of space warfare has underscored the speed and ease with which information must flow to preserve America's advantage in space. Space operators must continue to develop relationships across the full range of national security space and refine procedures to ensure future com-

manders have at their disposal a robust command and control architecture to protect America's space assets.

Notes

1. US Securities and Exchange Commission, "Investor's Advocate."
2. de Grazia, *Machiavelli in Hell*, 74.
3. Peng and Yao, *Science of Military Strategy*, 116.
4. Stokes, *China's Strategic Modernization*, 9.
5. Kulacki, "Chinese Perspectives on Transparency and Security."
6. Ibid.
7. "PLA 'Not Involved in Arms Race.' "
8. Kondapalli, "PLA Transparency with Chinese Characteristics," 5–10.
9. Martel and Yoshihara, "Averting a Sino-U.S. Space Race," 29.
10. Kraft, "Growing International Space Capabilities."
11. Harrison, address.
12. Martel and Yoshihara, "Averting a Sino-U.S. Space Race," 28.
13. James Mulvenon offers an excellent summary of the military-to-military visits that have taken place since the Chinese ASAT test. He notes visits to China by the chairman of the Joint Chiefs, Gen Peter Pace, and Pacific Command commander, Adm Timothy Keating; reciprocal visits by the PLA navy commander, Adm Wu Shengli, to the United States; and an exchange between deputy chief of the General Staff, Zhang Qinsheng, and DOD leaders at the Shangri-la Dialogue in Singapore. Mulvenon, "Make Talk Not War," 1–14. Since Mulvenon's article was published, the chairman of the Joint Chiefs, Adm Michael Mullen, visited Chinese leaders in August 2007, and Defense Secretary Robert Gates traveled to Beijing in November 2007. See Gertz, "Chinese Still Silent on Space Weapons"; and "Concerns Persist over Chinese Anti-Satellite Test."
14. Gertz, "Chinese Still Silent on Space Weapons."
15. House, *China: Recent Security Developments*.
16. Kulacki, "Chinese Perspectives on Transparency."
17. Gertz, "U.S. Halts China Space Ventures."
18. Knowlton, "Bush Aide Sees 'Cop-Out.' "
19. The USAF operations-to-operations program currently engages 11 countries: Great Britain, France, Australia, Israel, Italy, Germany, Japan, Singapore, Chile, Korea, and the Netherlands. Jones to the author, e-mail.
20. Kaufman and Linzer, "China Criticized for Anti-Satellite Missile Test," A01.
21. Covault, "Intensify Faceoff."
22. Gertz, "Space Defense."
23. House, *Congressional Record,* 110th Cong., 1st sess., H14485.
24. Treverton, *Next Steps in Reshaping Intelligence*, 9.
25. House, *Congressional Record,* 110th Cong,, 1st sess., H14485. Although the House reviewed the Senate proposal, it never made it into the final 2008 *National Defense Authorization Act*.
26. Mahnken, *Uncovering Ways of War*, 1–4.
27. Handel, "Technological Surprise in War," 13–16.

28. Gordon and Cloud, "U.S. Knew of China's Missile Test."
29. Covault, "China's Asat Test."
30. Forden, "Measure of Success."
31. "Senate Intel Authorizers Want New Office to Monitor Space Threats."
32. "Shelton: Space Warfare Is Certain."
33. Owen Hagovsky (space futures analyst, National Air and Space Intelligence Center, Wright-Patterson AFB, OH), in discussion with the author, 13 April 2007.
34. Dr. Lyle Goldstein (director, China Maritime Studies Institute), interview by the author, 10 April 2007. The CMSI conducts extensive research of Chinese professional journals posted to the China National Knowledge Infrastructure database. The database includes thousands of journals and technical articles, several hundred of which are dedicated to aerospace.
35. Scott Feairheller (principal analyst, space navigation systems, National Air and Space Intelligence Center, Wright-Patterson AFB, OH), in discussion with the author, 13 April 2007.
36. Treverton, *Next Steps in Reshaping Intelligence,* 7.
37. Col Dustin Tyson (Air Force Intelligence, Surveillance, and Reconnaissance Agency, National Air and Space Intelligence Center), interview by the author, 8 February 2008.
38. Butler and Bruno, "With Antisatellite Threat to US Military."
39. Treverton, *Next Steps in Reshaping Intelligence*, 10.
40. Short, address.
41. The information presented in this paragraph was originally derived from a variety of informal interviews with a number of individuals, all of whom requested anonymity. However, General Shelton confirms all the points made here in his 4 March 2008 testimony to Congress, stating that

> we've derived many lessons from the Chinese ASAT event, chief among them being the tremendous wealth of SSA [space situational awareness] data available, albeit in many disparate systems and security channels. It took the heroic efforts of many to manually assemble this information ad hoc, then pass it to senior decision makers. While we were very successful in this case due to the outstanding cooperation between the intelligence and operations communities, we clearly need improved processing and analytic systems that continually compile and automatically fuse SSA information in real-time to keep us abreast of space events. Our lessons learned from the Chinese test will continue to guide our future improvements and developmental efforts for the JSPOC.

Senate, *Defense Authorization Request for Fiscal Year 2009, Statement of Lieutenant General William L. Shelton*, 4.

42. Rumsfeld to chairman, Senate Armed Services Committee, letter.
43. Schanz, "Split-Up in Space."
44. Morgan, *Images of Organization*, 174.
45. Schanz, "Split-Up in Space."
46. Ibid.
47. Morgan, *Images of Organization*, 175.
48. Hon. Peter B. Teets (distinguished chair, Eisenhower Center for Space and Defense Studies), interview by the author, 8 March 2008.

Chapter 5

Economic Dimension

The world is moving to new uses of space, and our technology in the United States has not progressed because of the time and expense it takes us to do a mission.

—Robert Conger, vice president of Microcosm Inc., 2007

Response Option: America must revive the enterprising capitalist and the innovation that has long fueled its economic engine. Unencumbered by oppressive export laws, the US space technology sector has a chance to regain its prominence throughout the global market. The US military's capacity to achieve space superiority is a function of the capacity of the industry that supports it.

Identifying practical options within the economic sphere of influence to counter China's space weapon ambitions is perhaps the most difficult to analyze. The underlying challenge becomes apparent when one considers the nexus of two incredibly complex, cognitively dominant systems: international relations and international economics. Second- and third-order effects derived from decisions made in these areas of human interchange are not always obvious to the policy makers who implement change. Jervis argues that "many crucial effects are delayed and indirect; the relation between two actors often are determined by each one's relations with others; interactions are essential and cannot be understood by additive operations; many outcomes are unintended; regulation is difficult."[1] Jervis's observations are particularly relevant when applied to US-China relations. While contemplating the effects of closing the Strait of Hormuz with three strategically placed mines, US military strategists called upon leading economists for an assessment of secondary and tertiary effects. The strait is one of the most critical choke points for much of the world's oil supplies, and the economists were at a loss to describe the worldwide economic impact such a strategic move would have. One ana-

lyst replied soberly, "Our models aren't capable of predicting such an outcome."[2]

No Economic Sanctions

For good reason, there is no evidence the Bush administration considered new economic sanctions against China in the wake of the 11 January ASAT demonstration. Controversy surrounding the efficacy of economic sanctions has been longstanding. Historically, economic sanctions have a poor record of accomplishment. A 1990 study by the Institute for International Economics concluded that "between 1914 and 1990, various countries imposed economic sanctions in 116 cases. They failed to achieve their stated objectives in 66 percent of those cases and were at best only partially successful in most of the rest." Since 1973 the success ratio for economic sanctions has "fallen precipitously to 24 percent for all cases."[3]

US economic sanctions against China have taken various forms since 1969 when Pres. Richard Nixon initiated normalized trade relations with the PRC. The brutal 1989 Chinese government suppression of pro-democracy demonstrators at Tiananmen Square led to a host of new and renewed US sanctions against China. Today, human rights conditions in China and the threat of proliferation of weapons of mass destruction resulting from China's lack of export controls or lack of cooperation with international export control standards continue to be the main foreign policy and national security issues that hold these economic restrictions in place.[4]

Present-day policy makers may be reluctant to further manipulate export controls to China because of the disastrous consequences of policies enacted in the 1990s. In his book *Systems Effects: Complexity in Political and Social Life*, Jervis argues that the inherent interconnectedness of complex systems make them particularly vulnerable to misapplied policies. He notes that "interconnections can defeat purposive behavior. Not only can actions call up counteractions, but multiple parties and stages permit many paths to unanticipated consequences."[5] Jervis cites numerous examples to support his point, including Jay Forrester's argument that "building subsi-

dized housing attracts more poor people to [a] city and increases the tax rate, thereby making the city less attractive to business and so decreasing employment."[6] The result of targeted changes within a complex system can produce outcomes contrary, if not opposite, to the originally conceived goal of the stimulus. In this context, a case study of two Chinese launch failures in the 1990s informs the debate.

The Cox Report

The January 1995 failed launch of the *Long March 2E* rocket carrying Hughes-built *Apstar 2* spacecraft and the February 1996 failed launch of the *Long March 3B* rocket carrying Space Systems/Loral-built *Intelsat 708* spacecraft started a chain of events that has severely diminished, if not completely destroyed, US competitive advantage in the areas of space launch and satellite technologies. Because of the launch failures, the US Department of Commerce granted permission to the US satellite manufacturers to exchange technical data with interested parties, including Chinese space launch experts and representatives from the manufacturers' respective insurance companies. However, a congressional review later determined the Commerce Department had acted without authority and asserted that the launch failure reviews were conducted without required Department of State export licenses and communicated technical information to the PRC in violation of International Traffic in Arms Regulations (ITAR).[7] The investigation produced a congressional report, known as the Cox Report, and led to legislation that returned control of the licensing process for satellite and related technologies from the Commerce Department to the State Department.[8] Concurrently, the new law removed the same items from the control of the Export Administration Regulations and placed them under the jurisdiction of the United States Munitions List (USML).[9]

There is little doubt that US legislators believed they were acting in the best interest of the country. Presumably, it was clear to them that the information shared with Chinese officials compromised America's standing as the technological leader in the space industry. One damning piece of evidence, as revealed

in the Cox Report, was a Defense Department monitor's final report after a 1998 PRC launch campaign.

> This assignment for DTSA (the Defense Technology Security Administration) has proven to be exceptionally taxing and difficult. We are trained, given the necessary tools/skills and expected to protect U.S. technology from improper disclosure/compromise.
>
> Our responsibilities as monitors become transparent when aerospace companies (some not all) are given a Commerce License. It is viewed by industry as a license to steal and the monitors are a necessary evil to pacify management and our government.
>
> There is a general consensus within the public sector that, if restrictive measures and significant penalties are not levied against industries (specifically aerospace) by the Commerce Department (or higher), our technology will be compromised to such a staggering level and that our highest level of technology advancements will be available to our international competitors before [they come] off the research and development floor.
>
> We as a nation cannot allow or afford to have industry police itself when it comes to national security. . . .
>
> History is filled with unnecessary shortcuts in safeguard/security procedures resulting in the loss of American lives and federal grand jury investigations into illegal transfer of our technology by major corporations in an effort to increase their profit.[10]

While the events surrounding the Chinese launch failures and the ensuing technical interchanges between Chinese launch officials and US contractors produced signs of smoke, it is not clear there was any real danger of fire. The Cox Report findings have been widely criticized as the product of a politicized agenda, and although several studies and reports have since attempted to characterize the extent to which China has benefited from the technological information it received from US sources, it remains unclear that the infractions represented a credible threat to national security. One interagency report, compiled at the behest of the Cox Committee, concluded that no apparent modernization of China's deployed strategic force or nuclear weapons deployment resulted from US-derived sources.[11] Several leading defense analysts, including a panel of scholars from Stanford University, have challenged the veracity of the Cox Report, calling some of its findings "unwarranted" and characterizing the bulk of the report as an "unbelievable rush to judgment."[12]

Despite the skepticism with which some post-analysis commentators have treated the Cox Report, its effect on US policy spread almost immediately. The Strom Thurmond National Defense Authorization Act of 1999, alluded to earlier, included recommendations that, during implementation, assumed a state of agency all their own. The State Department not only assumed responsibility for space technology control, it applied a level of rigor and rigidity that went beyond the intent of the original legislation. For example, the act states that some of the most intrusive aspects of the controls do not apply "to the export of a satellite or related items for launch in, or by nations of, a country that is a member of the North Atlantic Treaty Organization or that is a major non-NATO ally of the United States."[13] However, since no corresponding legislation directed similar changes to the International Traffic in Arms Regulations, the State Department embraced a functionally restrictive interpretation, and US satellite manufacturers suddenly faced an excruciatingly bureaucratic hurdle in place of well-established export processes.

ITAR: The Path to Hell

One anonymous philosopher once quipped that "the path to hell is paved with good intentions." Jurisdiction under ITAR, a change implemented with the best of intentions, has become a living hell for America's space industry. The bureaucratically intense restrictions, regulations, and licensing requirements that typify the current process have hamstrung the US space industry to the point that foreign entities no longer care to do business with US manufacturers. Nearly every metric used to determine the overall health of the space industry has trended downward since Congress enacted the more restrictive legislation. Prior to the change in export controls in 1999, the United States dominated the commercial satellite-manufacturing field with an average market share of 83 percent. Since that time, market share has declined to 50 percent.[14] Likewise, the US share of satellite manufacturing revenues and satellite exports has declined over the past decade, while the US share of the overall foreign space market has fallen over 10 percent.[15]

Much of the decline can be attributed to the increasing difficulty foreign entities face when dealing with US export laws. Numerous foreign companies and governments are no longer interested in purchasing US products that come with severe legal ramifications. European aerospace executives claim that export customers are demanding with increasing frequency "ITAR free" systems.[16] Canadian Telesat has stated, "We will not buy from [the] US due to export controls."[17] Moreover, ITAR-free components such as apogee motors, thruster control valves, star trackers, microwave components, and satellite busses have replaced US components on the world market. The US export control laws have, in effect, created an entire new market for ITAR-free components—a market in which US industries are excluded. According to Joseph Rouge, director at the National Security Space Office, export controls have not only failed to prevent the rise of foreign space industries, they actually encouraged foreign industry growth. At the 2008 National Space Forum, he noted, "Two nations have actually declared openly that their space industry is due to ITAR. Well that wasn't exactly the plan for ITAR. The plan for ITAR was to keep them from having their own space industry, but we essentially did it for them because we gave them an incentive to do it."[18] Defense experts contend that Europe's decision to enter the space launch industry with the French Ariane booster was primarily in reaction to US efforts to control what the Europeans could launch on US boosters. The Ariane has since become the largest competitor to the US launch industry.[19] Daniel Sacotte, the head of the European Space Agency's Human Spaceflight program, believes export controls have made cooperation with the United States "too complicated to be feasible." He states that "we are now obliged to develop our autonomy in various areas, which is no bad thing. . . . We may also find partners besides NASA."[20] The Indian prime minister, in an address before members of the Indian Space Research Organization, commented that "it is a matter of particular pride that international technology denial regimes have not impeded your efforts—in fact, they have spurred you to greater heights."[21]

One contentious issue regarding the ITAR regime is its slow and unpredictable licensing process. Space systems and information providers generally have to submit a technical assis-

tance agreement (TAA) and wait for approval before discussing technical solutions with potential international clients. According to a recent Air Force Research Laboratory analysis of over 200 space companies, the process has become increasingly unpredictable and unnecessarily lengthy over the past five years, jumping from an average of 52 days in 2003 to an incredible 106 days in 2006.[22] This becomes especially problematic when one considers the competitive environment wherein a 60-day response requirement for new proposal requests is the norm. Some industry leaders claim the real travesty is the unpredictability of the process. There is very little transparency in the process, making it difficult for companies to establish timelines and meet customer's expectations. Marion Blakey, president and chief executive officer of the Aerospace Industries Association, notes that "export controls are like death and taxes . . . but I certainly would not underestimate the challenges and impediments that the current [ITAR] regime poses for us. Predictability—knowing what you can promise a customer and how you move forward—affects everything."[23]

Although the timeliness of the TAA approval process is disconcerting, most members of the space industry believe that the Munitions List, often referred to as "the list," lies at the heart of the problem. The list prohibits the unlicensed transfer of spacecraft technologies, including "communications satellites, remote sensing satellites, scientific satellites, research satellites, navigation satellites, experimental and multi-mission satellites," as well as "all specifically designed or modified systems or subsystems, components, parts, accessories, attachments, and associated equipment" of such articles.[24] As noted earlier, the State Department's rigid enforcement of ITAR restrictions has become a significant hurdle for America's space industry. One example brilliantly illustrates the ill-conceived manner with which the US government has implemented these laws. Bigelow Aerospace (BA) is a privately funded space venture with a goal "to create a new, robust, private sector-driven space industry by dramatically reducing the costs of conducting space-based activities."[25] The exclusive focus of the company is developing next-generation space habitats based on expandable technology. The following excerpt is from a colorful law review drafted by BA's legal counsel, Michael Gold, after

his attempt to fulfill ITAR requirements during a recent 2006 project in Russia.

> The cost, time, and trouble of export control would all be worthwhile if Bigelow Aerospace actually had any militarily sensitive technology that was worth protecting from the Russians. The problem was we didn't, and hundreds of thousands of dollars, years of effort, and valuable government resources were wasted monitoring systems that aren't even as sophisticated as what the Russians have themselves produced. Herein lies the fundamental flaw with the Department of State's enforcement of the ITAR, commonly available and well-understood space-related technologies should not and cannot be treated under the same regime as sensitive space systems with real military applications.
>
> I cannot think of a better example of the irrationality and waste of the ITAR than the treatment of a stand that BA built to support the Genesis spacecraft. This "stand" made out of standard aluminum, was basically circular in shape and had several legs sticking out around the perimeter. Bottom-line, if you flipped the stand upside down one would be hard pressed to distinguish the stand from any other table located in your grandmother's kitchen. However, since the stand had been "altered" to fit the spacecraft, it was considered covered by the ITAR and therefore fell under a proviso in our TAA that required 24/7 monitoring by a security staff of two. One can only imagine the implications of the Russians obtaining such sophisticated technology. If sold to the Iranians, within weeks or months you could have members of the Revolutionary Guard drinking coffee or even tea with the help of this new "table" technology.[26]

As illustrated in this passage, industry representatives are most frustrated with the poorly conceived logic the State Department applied in its attempt to protect items that are currently available to anyone on the world market. As implemented, the law does far more harm than good to US national security by suffocating the US space industry's access to foreign markets. Gold concludes, "In short, if the objective of the 1998 export control reforms expanding the ITAR were to cripple domestic US capabilities, lose billions of dollars, and bolster European competition all without impacting China, then we should rest assured that the mission has been accomplished."[27]

Fixing ITAR

Efforts to ensure a robust and healthy space industry represent a critical part of the US economic response to China's ASAT demonstration. The Navy has rightly tied its strength and liveli-

hood to the health and prosperity of the US shipbuilding industry. Indeed, the prosperity of the industry was one of many criteria that routinely influenced the US Navy's force structure and future maritime strategy to preserve dominance within the contested domain of sea.[28] The same is true of the US space industry. General Kehler recently observed that

> at the end of the day for us [Air Force Space Command], space capabilities that we can deliver to America's warfighting commands and to our coalition and allied partners [are] directly related to the capability of the US industry to produce [them]. We get very concerned when industry is suffering because of policy direction or implementation. . . . We are still struggling to get space capability deployed soon and we will continue to struggle with that until we make some different strategic choices.[29]

The first of several strategic choices available to policy makers interested in preserving America's technological advantage is to stop classifying communication satellites and other commercial spacecraft technology as "weapon systems." This requires a fundamentally different solution set when compared to the efforts of the Bush administration. In January 2008, the Bush administration implemented an Export Control Directive, measures to streamline the license approval process through mandated timelines, increased resources, and web-based applications.[30] Unfortunately, the directive misses the mark by not removing commercially available technologies—those that have become global commodities—from the protected US Munitions List. In some cases, the rapid proliferation of space services has driven commercial technologies to compete directly with what have historically been military technologies. Google Earth and Yahoo Maps, for example, have drawn criticism from both the Indian and US governments over the high resolution, military-grade imagery the companies make available free via the Internet. Lt Gen Michael Hamel, former commander of the Air Force's Space and Missile System Center, observed that "we're seeing a significant growth in both civil and commercial remote sensing capabilities. . . . [Commercial entities] in this country and in various other nations are actively developing and fielding capabilities. It wasn't too many years ago that what would have been our cutting edge reconnaissance capability, now are commercially purchasable products."[31]

The next step is to establish other mechanisms to regulate the proliferation of moderately sensitive technologies, while aggressively employing ITAR control only over the most sensitive of US technologies. John Rood, undersecretary of state for arms control and international security, notes that historically, 99.99 percent of all British licenses are approved. New treaties with Britain and Australia, if approved by the Senate, could potentially remove a total of 17,000 licenses from the system every two years.[32] Treaties and similar mechanisms should aim to encourage trade with close US friends and allies. Marion Blakely believes that "the debate on this has moved, from talking about competitiveness and the drag on US companies that ITAR poses to the issue that we are in a position of denying to our allies and friends the critical technologies that provide for the war fighter. This is a large part of the motivation to change the process."[33]

The final solution is likely to be one sponsored by multiple agencies, including the Departments of State, Commerce, Defense, and National Intelligence, bolstered with bipartisan congressional support, and received with commitment and resolve by the new administration. It is debatable whether such an alignment of the stars is possible. ITAR reform did not receive significant, if any, political attention in the lead-up to the 2008 presidential election. The space industry and its relatively benign political action committees have hitherto been unable to influence the national agenda in this regard. Some speculate if export control policy vis-à-vis the satellite industry might represent the type of intractable problem for which a national space council is needed to advise the president and shape the interagency perspective. Former USECAF Peter B. Teets acknowledges that cohesion is vitally important: "We need to have cohesion. OSTP [Office of Science and Technology Policy] needs to examine the process carefully. There are simply too many stakeholders involved [to achieve the cohesion needed]."[34] General Moorman takes a direct approach, stating that "we need to re-establish a White House organization for space activity. . . . Bush I [Pres. George H. W. Bush] had a national space council, but after that it went away. . . . There is [currently] no executive level leadership to drive these things through."[35]

Summary

Toyota's senior executives believe in the paradox of innovation: to keep it, one must give it away. When asked why Toyota routinely shares the most intimate details of its operations with competitors from General Motors, one executive replied, "As long as we keep innovating, no one else in the industry can catch up. What better way to motivate our people but to advertise that GM is walking around and seeing everything we are doing today."[36] Perhaps every US space industry executive, upon hearing this story, smiles wryly and sighs, "if only it were that simple." Yet the point made by Toyota executives is simple: the key is not protection but innovation—the innovation is about the economic engine and how the nation can support it.[37]

The fact is that while the proliferation of space power may not be a zero-sum game, in many respects, that is precisely how corporate America views market share. The very existence of an emerging market for "ITAR-free" goods is a poignant reminder of the vast global market share still out of reach for many US companies. For the better part of the twenty-first century, the space industry has struggled to mitigate the harmful effects of a policy designed to protect America's status as the world leader in space innovation. First, US companies want predictability. Second, industry leaders want ITAR to protect sensitive military technologies, not technologies widely proliferated and commonly available for civil and commercial space systems. The US Munitions List must restrict the fewest possible technologies—only the true jewels of the industry. Finally, US companies want to eliminate the unnecessary licensing procedures still required for America's closest allies. We must allow the industry to work freely with other allied nations in the same way we expect our military forces to fight wars. The paradox of ITAR has destroyed the vertical harmony within the economic dimension.

Notes

1. Jervis, *System Effects*, 29.
2. Hinote, lecture.
3. Hufbauer, Schott, and Elliott, *Economic Sanctions Reconsidered*, 92–93, 105–7.

4. Rennack, *China: US Economic Sanctions*, i.

5. Jervis, *System Effects*, 18.

6. Ibid.; and Forrester, *Urban Dynamics*, 67. In studying the impact of low-cost housing to urban development, Forrester concludes that "the results demonstrate the counterintuitive nature of complex social systems by showing that intuitively sensible policies can affect adversely the very problems they are designed to alleviate" (70).

7. Zelnio, "Short History of Export Control Policy."

8. The Cox Report is named after the Select Committee's chairman, Rep. Christopher Cox.

9. The USML is controlled under section 38 of the *Arms Export Control Act*. Zelnio, "Short History of Export Control Policy."

10. House, *Report of the Select Committee on U.S. National Security*, vol. 2, 233.

11. Kan, *China*, CRS Report RL30143, 7–8. The author is grateful to Joan Johnson-Freese for identifying this source. See Johnson-Freese, *Space as a Strategic Asset*, 157.

12. Pincus, "Hill Report on Chinese Spying Faulted," A16. The author is grateful to Joan Johnson-Freese for identifying this source. See Johnson-Freese, *Space as a Strategic Asset*, 157.

13. de Selding, "Export Issue Touches Europe," 20. The author is grateful to Joan Johnson-Freese for identifying this source. See Johnson-Freese, *Space as a Strategic Asset*, 158.

14. Zelnio, "Effects of Export Control on the Space Industry." There are five companies which dominate the sector: Boeing Satellite Development Center (formerly Boeing Satellite Systems), Lockheed Martin Commercial Space Systems, and Space/Systems Loral in the United States, and Alcatel Alenia Space and EADS Astrium in Europe. There are also a number of smaller companies that fill certain niches in the market: Orbital Space Sciences (United States), Israeli Aircraft Industries, Mitsubishi Electronics Company (Japan), Energia (Russia), and the China Academy of Space Technology.

15. This is according to data collected by the Federal Aviation Administration, Institute for Defense Analyses, NASIC, and Satellite Industry Association. Young, Ballhaus, and Chao, address, 30.

16. DOD, *Defense News*, 19 June 2007.

17. Young, Ballhaus, and Chao, address, 50.

18. Rouge, address.

19. Johnson-Freese, *Chinese Space Program*, 118.

20. Young, Ballhaus, and Chao, address, 23.

21. Ibid.

22. Ibid., 49.

23. Blakey, address.

24. ITAR, 22 Code of Federal Regulations (CFR) 121.1, Category XV—Spacecraft Systems, 440–41.

25. Michael N. Gold (corporate counsel, Bigelow Aerospace), interview by the author, 7 February 2008.

26. Gold, "The Wrong Stuff," 6–7.

27. Gold, "Lost in Space," 3.
28. The author attended several speeches and conferences at the Naval War College from 2006 to 2007 that reinforced this point.
29. Kehler, address.
30. Clark, "Officials Say ITAR Changes Don't Solve the Big Problems," 11.
31. Lowe, " 'Google Earth' a Potential Space Threat."
32. Clark, "Officials Say ITAR Changes Don't Solve the Big Problems," 11.
33. Blakely, address.
34. Hon. Peter B. Teets (distinguished chair, Eisenhower Center for Space and Defense Studies), interview by the author, 8 March 2008.
35. Moorman, address.
36. Gass, address.
37. Ibid.

Chapter 6

Military Dimension

> *You can look at somebody's motives and say, "There's no real intent that I'm aware of that they want to do me harm." But if they've got the capability to do me harm, as a warfighter, that's what I've got to respect—because intent can change overnight. As the capability evolves on the part of the people who would want to do us harm in space, you've got to stay ahead of them.*
>
> —Maj Gen William Shelton, USAF, 2007

Response Option: America's military must prepare to defend its space assets. A robust shared space surveillance (SSS) construct may increase national security through enhanced space situational awareness and international cooperation.

General Shelton's edict in the epigraph above reflects his war-fighting pedigree. As a military strategist, he understands which capabilities the United States needs to defend against potential military adversaries. Of course, the salient question becomes, how? If indeed the US military will one day conduct combat operations in space, as Shelton suggests, then what national security space strategy can successfully parlay America's limited resources into the proper force structure necessary to protect the nation?[1]

The situation has all the makings of the classic security dilemma discussed in chapter 2. ASATs represent a relatively simple, cost-effective option to counter what Chinese military leaders describe as an expanding US space hegemony—a perception pervasive throughout Chinese strategy circles.[2] In response, US military leaders interpret China's actions as overtly threatening and implement measures to sustain America's hegemonic status. Within days of China's demonstration, Secretary Wynne declared that "space is no longer a sanctuary; that veil has now been pierced. . . . Freedom of space is crucial and the Chinese, wittingly or not, have sent a message that our guard must be stronger. . . . This change is seismic in nature.

The recent Chinese test marks the turning point in the work our country must do to assure space dominance."[3]

Military leaders have suggested the "work" begins by developing a robust level of space situational awareness. In his 2007 written testimony to Congress, General Cartwright explained that "historically, space situational awareness (SSA) was focused on the cataloging, tracking, and monitoring of objects in space via the space surveillance network. Today it is clear we must have better space detection, characterization, and assessment tools. We require capabilities that enable rapid threat identification and attribution, facilitate a defensible architecture and provide fundamental shifts in space awareness."[4] Days earlier, Gen Kevin P. Chilton, commander of Air Force Space Command, testified that "today, our surveillance, analysis and data-sharing capabilities do not adequately support our future needs to rapidly identify and understand the threats to our space systems."[5] In truth, US military leaders had long before identified the critical need for space situational awareness. As General Shelton describes it, "It's a work in progress . . . [but] the Chinese ASAT test put us on a much more rapid path than before."[6]

Despite the annual testimony offered by the nation's space leaders, it is possible that the US military apparatus writ large underappreciates the challenge beyond earth's atmosphere. Modern air, sea, and land commanders would never consider placing their highest valued assets into an essentially blind operating environment. In fact, quite the opposite is true. For example, the Air Force specifically designed the F-22 Raptor to achieve total air battlespace domination. The Raptor fuses data from multiple sensors to create a level of situational awareness unrivalled by any other air-breathing platform in existence. Not only can the Raptor "see" all incoming threats, but it can also target and destroy them before they are even aware of the Raptor's presence. Naturally, one must wonder why the world's most advanced space-faring nation would not assure a similar degree of protection for its space-based assets—of course, this is not the case.

In fact, the US SSN is currently a kludge of slow, outdated processors coupled with radar and optical sensors dating back to the Cold War–era, designed primarily to surveil the Soviet Union. General Hamel understands well that the nation's space surveillance capabilities, while currently more comprehensive

than any system operated by other space-faring nations, are still woefully inadequate to meet the needs of modern space commanders. He was asked to fix it. According to Hamel, the solution lies in integrating the existing structure with new space-based capabilities and collateral sensors designed to support other programs such as missile defense. He notes that "our priority is to look at ways to knit and net together sensors in a much more operationally responsive fashion so we can maintain continuous knowledge as events and situations change. New and advanced sensors . . . like SBSS will become part of that architecture as that satellite is completed and launched."[7] To this end, the SMC is programming funding for integrated space situational awareness, an effort to provide the architecture and integration necessary to *minimize* the nation's vulnerabilities in this area.

However, the SMC and America's space force are facing increasing challenges in the area of space surveillance, and it is not clear whether the current programming efforts and funding levels will ensure the nation keeps pace with a problem that is becoming more complex. From 1995 to 2007, the number of objects tracked in space grew from roughly 10,500 to 18,500.[8] Much of the increase is the result of breakups—large pieces of debris collide with other objects and break up into multiple smaller pieces of debris—however, the overall number of launches worldwide continues to increase as well. Consider that China, during its 10th Five-Year Plan, launched a total of 28 satellites and spacecraft on 26 launchers, steadily increasing from just one in 2001 to a peak of eight in 2004.[9] All indicators suggest that China seeks to maintain a leading role in space launch activity. In 2006 the PRC State Council issued a white paper describing its goals for the 11th Five-Year Plan, characterized by a marked increase in space applications including satellite remote-sensing, communications, and navigation.[10] Furthermore, China hopes to strengthen its position as a worldwide provider of commercial and military launch services. One US assessment suggests that Beijing's goal is to place a satellite into orbit "within hours upon request."[11]

Moreover, the SMC may be facing a trend more challenging than the increase in sheer numbers of spacecraft in orbit. The trend toward miniaturization translates to a greater number of

very small objects in space that are significantly more difficult to detect and track. Currently, the SSN tracks only those objects greater than 10 centimeters in diameter. Consequently, a new generation of satellites has emerged that may eclipse the threshold of America's capabilities to surveil. While the United States continues to develop microsatellite technologies through programs such as TacSat-2 and XSS-11 to meet mission requirements for proximity and rendezvous operations, China has become increasingly interested in both the military and commercial uses of microsatellites.[12] In a recent study of Chinese microsatellite applications, Andrew Erickson suggests that Chinese aerospace engineers are conducting extensive research in a variety of subfields including digital synthesis simulation, liquid gas propulsion technology, geomagnetic-based independent navigation methods, remote sensing, and complementary metal-oxide semiconductor (CMOS) camera applications.[13] Furthermore, researchers at China's prestigious Qinghua University Space Center are pursuing even greater accomplishments in miniaturization, including nano- and pico-technology. Dr. Zhang Xiaomin reports that the institute is developing a one-kilogram picosatellite.[14] According to a *Jane's Intelligence* report, both the China Aerospace Science and Industry Corporation and the Chinese Academy of Space Technology are developing microsatellites and small satellites for commercial use and possibly military ASAT projects.[15] US military leaders also recognize the potential for microsatellites to fill counterspace roles. When discussing the XSS-11 program, one Pentagon official was harshly criticized by the media after articulating the possibility of using the microsatellite as a kinetic ASAT.[16] According to an annex of the Space Commission report, "These micro/nanosatellites, when employed as unacknowledged secondary payloads, can covertly rendezvous with other space assets to perform satellite inspection and other missions to disrupt, degrade or destroy space assets."[17] Furthermore, a witting adversary could potentially deploy a swarm of nanosats into a preexisting debris field, making it nearly impossible for space surveillance experts to discern between actual pieces of debris and highly maneuverable and deadly space weapons. Indeed, the United States may not know for years if that was the real purpose of China's 11 January "test." The potential application and proliferation of

micro- and nanosatellites as coorbital, kinetic-kill ASATs underscore the urgency with which US military leaders must work to establish a robust space surveillance capability.

Finally, General Hamel and other space leaders face significant Air Force budget constraints as they attempt to design and build a modern space surveillance capability. In recent years, the vast majority of discretionary spending within the national security space enterprise has been dedicated to recapitalizing a rapidly aging fleet of spacecraft, launch, and ground systems. Several major mission areas in space are currently undergoing a significant level of recapitalization: *intelligence, surveillance, and reconnaissance* (Space-Based Infrared System [SBIRS]); *communications* (Wideband Global Satellite Communications [WGS] and Advanced Extremely High Frequency [AEHF]); *position, navigation, and timing* (Global Positioning System [GPS] IIF and III and GPS Architecture Evolution Plan [AEP]); and *spacelift* (Delta IV heavy evolved expendable launch vehicle [EELV]).[18] The next 18 to 24 months promise to produce significant increases in America's space capability.

The critical need to recapitalize major space sectors translates into less money available for newer emerging mission areas like space protection. The phenomenon is a replay of a larger debate regarding the benefit of creating a new major force program (MFP) for the Defense Department's space budget.[19] The issue is that space programmers must continually compete for dollars within a largely air-centric construct. RAND analyst Benjamin Lambeth explains that "at present, there is a zero-sum competition going on between military space priorities and other USAF spending requirements, including its force-projection needs. Should the Department of Defense continue its current resource apportionment practices with respect to space, the Air Force will, in the words of one former senior space officer, find itself faced with 'the untenable option of capitalizing space with its increasingly limited resources.'"[20] For years the highest acquisition priority for the Air Force has been the F-22 Raptor. Today, the F-35A is the big-ticket air platform, with a combined fiscal year 2009 procurement and research budget nearly half that of the entire space portfolio.[21] The conclusion for space protection advocates is that the intense bud-

get constraints that have limited growth in the past will likely persist into the future.

The Chinese ASAT test on 11 January 2007 has generated congressional support for additional space surveillance and space protection dollars. For example, the House-Senate conference report on the 2008 defense appropriations bill added $100 million above the administration's request for nearly $200 million to accelerate space situational awareness.[22] However, it is not clear that token budget increases will solve the enduring problem of keeping pace with a rapidly expanding mission area. Consider the SBSS Block 10 spacecraft, a critical element of AFSPC's efforts to produce a robust space surveillance capability. The program has been plagued with a series of delays from its very start. Launch-vehicle problems, followed by service and congressional cuts in 2005, followed by programmatic challenges regarding the complexity of integrating the optical payload have caused a $223 million effort to grow to about $400 million.[23] In March of 2008, the DOD and the intelligence community cancelled Space Radar, a military and intelligence surveillance satellite, because of soaring programmatic costs that ranged as high as $20 billion.[24] In her 2008 testimony to Congress, Christina Chaplain of the GAO concluded that "senior leaders managing DOD's space portfolio are clearly working in a challenging environment. There are pressures to deliver new, transformational capabilities, but problematic older satellite programs continue to cost more than expected, constrain investment dollars, pose risks of capability caps, and thus require more time and attention from senior leaders than well-performing efforts."[25] The magnitude of the budget challenges space programmers face underscores the relatively benign impact modest congressional plus-ups actually have. Furthermore, it is not clear how long the Air Force will enjoy congressional favor as the emotional and psychological impact of China's space weapons demonstration begins to wane.

Shared Space Surveillance

The policy changes proposed in chapter 2 offer exciting options in the military dimension, and military leaders must consider teaming with other space-faring allies to form an

international security space alliance. For the military's part, uniformed leaders must play an active role in beginning a dialogue with allied military leaders from around the world. Twenty-eight foreign militaries currently operate in space, and each one has a vested interest in protecting its assets on orbit.

The concept is not significantly different from one the US Navy is considering. Faced with a dynamic operating environment and scarce resources, Admiral Mullen, then chief of naval operations, envisioned a "thousand-ship navy"—an allied fleet of ships working collectively to police the world's blue waters and ensure viable sea lines of communication to every nation's benefit.[26] A "thousand-sensor SSS system" may produce the type of capability commanders will need to police the stars, even if fiscal limitations preclude the unilateral employment of such a system. A notional space-surveillance architecture generated within the Pentagon suggests a need for sensors performing three distinct mission sets: routine surveillance, tactical surveillance, and tactical imaging. Through the employment of a variety of electro-optical and radar sensors, the SSA architecture must surveil both prograde and retrograde space objects launched from the world's major spaceports. Furthermore, a truly meaningful architecture must include a robust complement of space-based assets to surveil and image objects in both low-earth and geosynchronous orbits. The plan was labeled "Threshold Unconstrained Clean Sheet SSN," suggesting that the Pentagon understands that current fiscal realities preclude such a plan from ever coming to fruition. The space-based component alone would bankrupt the Future Years Defense Program. For example, as depicted in figure 2, up to 10 supersynchronous-based electro-optical satellites may be necessary to maintain law and order throughout the geosynchronous belt, with another seven traversing through geosynchronous and low-earth orbits.

When applied to the issue of space protection, the "thousand-sensor architecture" means every allied ground- and space-based SSA platform could potentially form an integrated operations system designed to keep "space lines of communication" open to all who contribute. One construct worth considering is the existing Shared Early Warning System, as it may be a logical starting point for a multilateral acquisition program. The con-

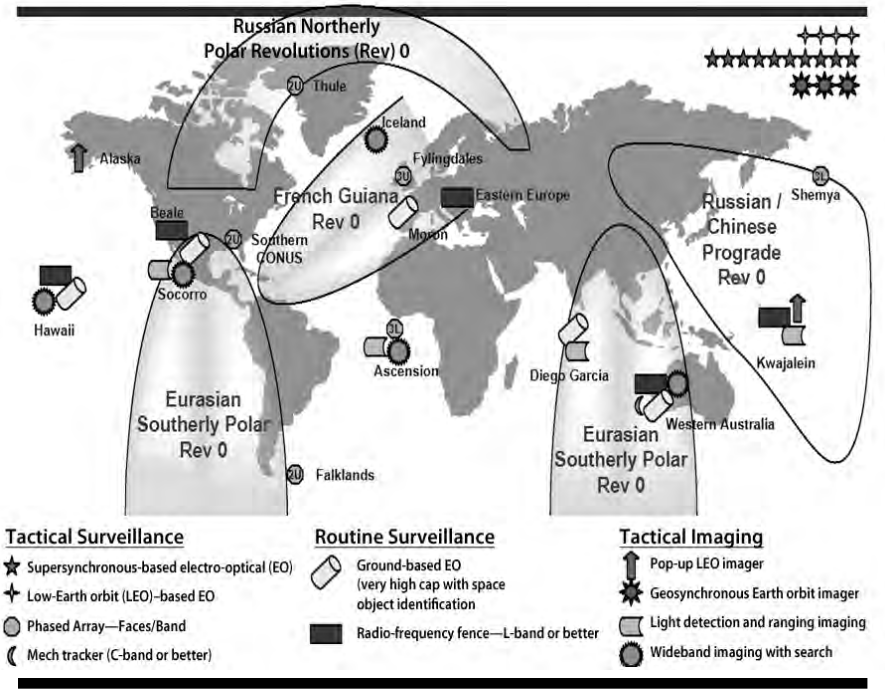

Figure 2. Notional space surveillance architecture. (*Reprinted from* Headquarters Air Force, Space and Nuclear Operations, briefing, subject: Space Situational Awareness, 20 February 2008.)

cept of shared early warning came about toward the end of the 1990s, when Russia's plummeting level of military readiness raised concerns about its ability to command and control its nuclear missile arsenal. The goal was increased transparency. The United States agreed to share the critical missile-warning data it received via satellite remote sensing and radar to remove any ambiguity that might otherwise cloud the judgment of Russian command-and-control centers. Robert G. Bell, a senior aide on the National Security Council at the time, explained that "the agreement provides further protection against an inadvertent nuclear exchange triggered by misidentification of a launch."[27] As discussed in chapter 3, increased security remains the key to establishing an enduring architecture.

Currently, several US allies, such as Japan, Canada, India, and the European Union (EU), are struggling with the same is-

sues of space protection that preoccupy US space commanders. For example, a 2005 European study concluded that

> the security of [space] systems become[s] a true challenge [when] taking into account the increasing security issue of the space debris proliferation. While Europe is able to detect and catalogue some space debris using European facilities implemented by some European Union Member States, most of the data are still provided for free by the United States of America. This situation could change in the near future and the data already provided are not exhaustive or [may] not be made available at the needed time. The lack of a European Space Surveillance Capability is identified as a serious capability gap that must be one of the priorit[ies] of the future European Space Program. Beyond the security of the European space assets, this system must contribute to the control of the application of International Space Treaties and to the evaluation of the activities of the space-faring nations or organizations.[28]

Theresa Hitchens, the director of the Center for Defense Information, suggests the tenor of such reports reflects a political desire for European nations to decrease their dependency on US space systems.[29] While her interpretation is plausible, it does not necessarily negate the possibility of formalizing interdependency between the United States and other space-faring allies. The EU faces far greater fiscal constraints vis-à-vis its military space budget, and political rhetoric alone will not fund the kind of robust space surveillance network needed to handle emerging threats. According to a 2004 study, an independent European space surveillance system with performance characteristics roughly equivalent to the current US space surveillance network will cost around 330 million euros (~$500 million in 2004 US dollars) to develop by 2015.[30] The alternative approach, partnering with the United States, would allow the EU to field sensors that cover deficiencies in the US network (for example, in the Southern Hemisphere where the United States has virtually no coverage) while in return earn guaranteed access to the entire system.

Top military officials admit such a plan has merit. Gen Kevin Chilton, USAF, commander of USSTRATCOM, testified that the United States "must continue to foster collaborative data-sharing with our allies to enhance global coverage. . . . The ability to leverage and expand space partnerships with our allies holds the potential to dramatically improve Space Situational Awareness."[31] Just weeks earlier at a conference in Washington, DC, General Kehler suggested it might be time to rethink

America's approach to national security space and consider the role other space-faring partners might play in an integrated framework. He commented, "I don't think we've gone about this in the past with an underlying assumption that says we want to include allies and international partners as a core piece of how we conduct our national security business with space capabilities. I think that has to change. Much like we have had alliance and coalition agreements with all of our other elements of our national security power, I think that it's important for us to pursue as an objective when it comes to our space capabilities as well." Kehler also noted that Australia's decision to purchase a WGS satellite and become part of the US military satellite communications architecture represents a very positive step toward an allied space force. "That one step that they have taken speaks volumes about a way for us to do business in the future," he observed.[32]

A team of space professionals in the Pentagon has set about the task to determine the possible areas of mutual interest with select allied air forces.[33] During a February 2008 trip to Paris, Air Force officials met with a delegation from the French air force to discuss data-sharing options in a variety of space mission areas, including space imagery, space surveillance (together with space meteorology), and space education. The CSAF-directed program is designed to build bilateral military-to-military relations at the staff, operator, and general-officer levels. The space delegation selected to participate in this bilateral engagement hoped to explore the potential for future coalition operations and partnership capacity—the fundamental building blocks for a future space alliance. However, two conditions must exist before the team's efforts in bilateral discussions bear significant fruit. First, the team members must embrace the notion that the old way of doing business offers little hope for future success. In other words, they must be open to innovative ideas based on the belief that new strategies and doctrine will be necessary to meet future requirements. Stephen Rosen suggests that military planners are "driven to consider the need for innovation by broad structural changes in the security environment in which their organizations would have to fight for the foreseeable future, not by specific capabilities or intentions of potential adversaries."[34] The implication is that senior leaders must recognize the Chinese ASAT test not as an

isolated event, merely attributable to one nation, but as a structural shift toward space as a contested environment. In this context, a space alliance may prove to be the innovative strategy necessary to ensure national security.

Space leaders must also acknowledge the inherent deterrent value in sharing space surveillance with a global audience. General Shelton explains that "if our adversaries know that we know what's going on in orbit, then they're going to be constrained."[35] To this end, the United States ought to consider including China as a space surveillance partner. China's ambitious plans in space will continue to drive requirements for an increasingly sophisticated space surveillance network. Furthermore, China's overall economic growth continues to climb at an unprecedented rate, surpassed only by the rate at which China has increased defense spending.[36] If major space-faring nations express interest in an international space alliance designed to ensure collectively the protection of global space assets through shared awareness, there is little doubt China will want to join. China's desire for international prestige and relevance takes precedence over its desire to become a major space power, and from China's perspective, the latter enables the former. As General Kehler notes, "When you get better situational awareness; when you have the capability to attribute; our view is that you are enhancing deterrence. It is becoming clearer to all that there's not a way to make an on-orbit activity look like an anomaly or a technical problem. It informs what a whole range of response options might be."[37] Consequently, the United States' best option in response to China's space weapons program may be to join together to lift the veil of obscurity shadowing orbital operations.

Summary

The vertical disharmony within national security space is largely attributable to the lack of a national space strategy. No single individual or office has purview over the entire military space infrastructure, which has struggled to translate national level policies into coherent, meaningful action. The result—national security space is stalled in a paradigm no longer useful to adequately

shape the global environment. A new, multilateral international security space alliance is one possible option for like-minded space-faring nations to prepare for operations in the contested environment of space.

Shared space surveillance has the potential to underpin a space protection strategy for all alliance members. Current trends in space surveillance suggest challenging times lie ahead: the number of objects in space is increasing, the size of these objects is decreasing, and the cost of new space systems continues to wreak havoc on defense budgets. Significant change will require horizontal integration across the instruments of power, but the onus is on the US military to begin the process by pursuing possible solutions with like-minded, space-faring nations and present options to its civilian leaders. Space superiority can be America's destiny, but US space forces must be prepared to achieve it with coalition partners, as do their land, air, and sea counterparts.

Notes

1. "Shelton: Space Warfare Is Certain."
2. Mastalir, "China's ASAT Test," 114.
3. "Cartwright: U.S. Needs Multifold Response."
4. Congress, *Defense Authorization Request for Fiscal Year 2008*.
5. Congress, *Fiscal Year 2008 National Defense Authorization Budget Request*.
6. Little, "Space Chief."
7. Chavanne, "Space Integral to Military."
8. Magnuson, "Murky Picture."
9. Pollpeter, "Building for the Future," 5.
10. Information Office of the State Council of the PRC, *China's Space Activities in 2006*.
11. DOD, *Annual Report to Congress: The Military Power of the People's Republic of China*, 2007, 42.
12. "XSS-11 Microsatellite."
13. Erickson, "Microsatellites," 8–9. Dr. Erickson cites a variety of published Chinese sources: Zhang, Chao, and Jiawei, "Microsatellite Digital Synthesis Simulation"; Wei and Xue, "Microsatellite Liquid Gas Propulsion Technology"; Zuo and Song, "Microsatellite Magnetic Survey"; Tang and Zhao, " 'Aerospace Qinghua 1' Microsatellite"; and Liu and Huang, "CMOS Camera in Microsatellite Applications."
14. "TS-1 (Tansuo-1)."
15. "ASAT."
16. Krebs, "XSS-11."

17. Wilson, "Threats to United States Space Capabilities," 5.

18. Congress, *Fiscal Year 2009 National Defense Authorization Budget Request for National Security Space Activities: Statement of Mr. Gary E. Payton*; and Ibid., *Statement of General C. Robert Kehler*.

19. The Commission to Assess US National Security Space Management, a panel led by Donald Rumsfeld, first recommended the concept of an MFP for space spending in its January 2001 report. However, the DOD chose to create a *virtual* MFP instead.

20. Lambeth, "Footing the Bill for Military Space."

21. Spencer, briefing, Air Force Budget Office charts 11–12.

22. Pincus, "Space Defense Program Gets Extra Funding."

23. Morris, "Decisions on SBSS Expected."

24. Clark, "Space Radar Is Canceled."

25. Senate, *Space Acquisitions*, 12.

26. Cavas, "Thousand Ship Navy."

27. Gordon, "Summit in Moscow."

28. European Commission, *Report of the Panel of Experts on Space and Security*, 36.

29. Hitchens, "Military Satellites 2006," 30.

30. Donath et al., "European Space Surveillance System Study," 2, 18, 23.

31. Congress, *Fiscal Year 2008 National Defense Authorization Budget Request*.

32. Kehler, address.

33. Unless otherwise indicated, this paragraph draws from a set of internal Pentagon documents presented to the French air force delegation. Headquarters Air Force, "USAF-FAF [French air force] Space Ops Working Group," 5 February 2008.

34. Rosen, *Winning the Next War*, 75.

35. Magnuson, "Murky Picture."

36. Analysis of PRC budget data and International Monetary Fund gross domestic product (GDP) data for the period of 1996 to 2006 reflects how average annual defense budget growth of 11.8 percent (inflation adjusted) compared with average annual GDP growth of 9.2 percent (inflation adjusted). DOD, *Annual Report to Congress: The Military Power of the People's Republic of China*, 2008.

37. Kehler, address.

Chapter 7

Findings/Conclusion

Even if the aim is much more ambitious, to devise and implement a grand strategy that will harmonize policy on all levels, the impediments can be overcome by great intellectual effort, sheer tenacity, and much political ingenuity.

—Edward Luttwak

China's ascendance as a major space power, as demonstrated by its acquisition and employment of space weapons, is a matter of consequence at the US grand-strategic level. Consequently, it is appropriate that the US response draws upon all elements of US national power. Physicist Thomas Kuhn once argued that new paradigms emerge when a crisis reveals the inability of the existing structure to provide a solution.[1] China's test may be the crisis that overturns the traditional US approach to national security space. If so, Luttwak's assertions defining the power of paradoxical logic and dimensional harmony in grand strategy provide a useful framework to explore possible US response options.

Still, the alternatives explored in this thesis were chosen for reasons beyond their paradoxical value. First, each represents a plausible option when measured against the assumptions stated at the beginning of this paper. These assumptions were drawn from a relatively comprehensive review of open-source material and selected based on a careful analysis of Chinese foreign diplomacy, military strategy, doctrine, culture, and bureaucratic politics as a possible means to better explain China's intentions.[2] Different assumptions would yield different response options. For example, the military strategist who believes China's expansionist goals include most of eastern Asia, the Pacific, and beyond (perhaps including Hawaii), could make a strong argument for immediate, aggressive military action. One would deem it foolhardy for the United States to wait when each successive year of Chinese military modernization repre-

sents a decline in the likelihood of a decisive US victory. Of course, the evidence does not support such assertions regarding China's expansionist goals or other forms of colonial or economic imperialism. Consequently, Senator Kyl's call for exorbitant space-based counter-ASAT platforms specifically designed to destroy China's space weapons should not receive a position of prominence in the final solution set.[3]

The alternatives explored in this paper are consistent with another limiting factor—resources. All too often studies of this nature include a wide range of options, from the fiscally possible to the fiscally inconceivable. Cost is then applied as a variable to ascertain which options are best, a largely futile exercise given the thin margins that exist in current military budgets. A more useful approach is to treat cost as a fixed constant, not a variable. Innovative solutions typically emerge when resources are constrained, and problem solvers are forced to stretch boundaries other than the nation's checkbook. Again, the assumptions stated at the beginning of this work do not warrant a radical restructuring of the president's budget; consequently, options requiring as much were not considered in this research. Minor adjustments within the DOD budget, however, may be necessary, such as creating a major force program for space to preserve the integrity of existing space appropriations. But prudence must prevail over zeal. Luttwak notes that the United States once "spent hundreds of millions of dollars on specialized antitank aircraft needed only against *massed* armor, which [were] never used because massed antiaircraft guns are then present as well."[4] The parallel here is that pouring hundreds of *billions* of dollars against one relatively modest, direct-ascent weapon is likely no wiser. Enduring solutions are far more prudent.

The challenge in formulating a US response, therefore, is choosing a solution set that measures favorably against the entering assumptions, fits within the existing budget, and finally, achieves horizontal and vertical harmony. For example, the disharmony in US foreign policy toward China is easily discernible when one attempts to answer a single question: does the United States want China to evolve as a major space power? On the one hand, one might instinctively answer no since a zero-sum mentality continues to shape US thinking about the

space domain. On the other hand, one could conclude yes based on numerous references in a great number of policy instruments and US efforts to integrate China into the global economy. Of course, the dialogue will invariably devolve to "*it depends*," based on the extent to which China's interests align with US interests. This level of disharmony, present throughout US policy instruments as well as its other instruments of power, makes it increasingly difficult to develop a coherent national security space strategy to complement or oppose China's rise—whichever it is the United States decides to do. Luttwak suggests, "Whether its goals are set by tradition, bureaucratic compromise, a dictator's whim, or democratic choice, they must be consistent. It does not matter if they are wise or foolish in anyone's opinion, but they cannot be mutually exclusive or ranked inconsistently, for otherwise the definition of a grand strategy cannot even begin."[5]

Vertical and horizontal harmony are critical if enduring solutions are to prevail. For example, the United States claimed vertical victory after a long feud between American and European space representatives over the frequency plan for Galileo, an EU alternative to the Global Positioning System. However, such victories can prove Pyrrhic if significant damage is incurred in the horizontal dimension. It remains to be seen if American rigidity over Galileo will significantly impair its ability to form an international security space alliance in areas such as space surveillance less than five years later. For the Europeans' part, China's new Beidou navigation system becomes more problematic every year, as recent developments suggest China intends to make the system available to both military (PLA) and commercial consumers, essentially undermining a large segment of Galileo's potential market share.[6] As the Europeans increasingly marginalized China's partnership status with Galileo, the Beidou program became an attractive option for Chinese policy makers. China has seemingly compensated its diminished influence in the vertical dimension with increased influence in the horizontal dimension, a move that may prove problematic for both the Europeans and the Chinese. The paradox of vertical success may ultimately preclude the enduring solution each party once sought. Michael Shaw, from the US government's National Space-Based Positioning, Navigation, and Timing Coordination

Office in Washington, DC, notes the irony. "Frankly, China's behavior towards Europe is not so different to how Europe behaved with us [the United States] when GPS was the only game in town a decade ago," Shaw stated.[7]

There are no fail-safe tests to determine which solution sets simultaneously offer vertical and horizontal harmony. However, a number of criteria may provide insight as to how one might proceed to formulate a US response. First, the options considered for inclusion in the final solution set must have some *reasonable source of political sponsorship*. Just as states rarely (if ever) act contrary to their own interests, organizations rarely assume significant risks without political cover. As America has recently gone through a national election cycle, timing may also impact the political calculus. Second, the options must provide for *enduring, rather than temporary effects*. Perhaps the truest test of multidimensional harmony is to consider whether the proposed options have the endurance necessary to weather extreme swings in the geopolitical environment. NATO serves as a reasonable example. Finally, the options must be *structural, not contextual* in nature. In other words, the options, as a whole, must represent a net gain for national security as opposed to just one that merely addresses a specific conflict. A structural solution is one that addresses the larger issue of the advent and likely proliferation of space weaponry rather than merely the seemingly provocative actions of China on 11 January 2007. The final step, therefore, requires one to assimilate the filtered options to define a solution set in terms of the relationships and interactions of multiple options or intervening variables. These variables are not necessarily competing options but rather feed into and support the US strategy for response. The final solution must have, at a minimum, political sponsorship, enduring qualities, and structural implications if it is to produce harmony in the vertical and horizontal dimensions.

The problem with the 2006 National Space Policy is not the form or function of the guidance it provides but the complete lack of energy with which it was introduced and consequently implemented. US representative Jane Harman characterized the problem perfectly when she stated, "Both the administration and Congress have been snoozing. . . . Seven years after the Rumsfeld Commission Report . . . and more than a year after the

Chinese ASAT test, we do not, in my view, have an adequate space strategy."[8] Fundamentally, the 2006 National Space Policy is not flawed. As a national-level instrument of policy, it provides the broad guidance necessary to build a national security space strategy. However, the competing interests of the DOD and the intelligence community have directly contributed to the horizontal disharmony within the policy dimension. The need for executive- and congressional-level leadership is urgent.

The new administration may choose to revise the national space policy as a mechanism to signal change in America's approach to national security space and international cooperation, further distancing the new administration from the preceding one. When this occurs, a number of actions must immediately follow. The new president should revive a White House–level national space council to ensure executive-level leadership remains engaged in space issues. As one of its first tasks, the council ought to conduct a thorough review of all relevant national policies to identify elements of contradictory or self-defeating policy guidance. In particular, the council must champion efforts to make substantive changes to export control directives.

The Congress must direct the secretary of defense and the director of national intelligence to produce a national security space strategy. Hitherto, neither organization has been able to lead the effort to consensus.[9] Such a strategy must underwrite future efforts to form an international security space alliance. For the military's part, efforts to explore areas of mutual interest with allied nations must continue in earnest. Military leaders should measure the interest of all space-faring nations to create an international space surveillance fusion center, perhaps modeled after NATO's new intelligence fusion center in Molesworth, United Kingdom.[10] Among other functions, the center should provide fused data for predictive analysis of space weather, comprehensive space object identification and tracking, and space traffic control services for worldwide launch and orbital maneuvers.[11] To be a powerful deterrent, the space-surveillance fusion center must attain the capability to identify and geolocate sources of interference originating from both ground- and space-based sources, effectively forming a neighborhood watch program for all contributing partners.[12] The key will be to identify the security interests common to all space-faring nations.

The brilliance of the international security space alliance is the way it achieves vertical harmony within the political/diplomatic dimension. The astute reader may have noted the apparent disharmony present among the various options described in that dimension. Several of the options serve only to strengthen the perceptions of other space-faring nations that the United States intends to conduct space warfare. For example, the US rejection of a space weapons ban juxtaposed with US efforts to establish definitions of hostile acts and intents in space are difficult to reconcile against the stated goals of the National Space Policy. However, the fusion center, as part of a broader international security space alliance, aptly aligns these efforts. Confidence-building measures, such as escalatory constraints, can be explored in an unassuming manner, as part of an alliance charter. Treaties designed to ban the use of weapons in space may become more palatable once space surveillance assets become capable of treaty verification. Conceivably, the alliance could one day employ defensive space weapons of its own, authorized to take the actions necessary to preserve each nation's access to its space assets.[13] The terrestrial corollary is a missile shield designed to protect all nations on earth, the implications of which are intriguing, even if they border on science fiction.

To create horizontal harmony across multiple dimensions, the fusion center must evolve to include space industry partners. Space, as a contested environment, creates consequences that extend beyond military space. The inclusion of commercial space entities serves two purposes. First, it extends the umbrella of space protection to commercial assets, which remain an integral part of the national security space enterprise. For example, the US military relies heavily on commercial communication satellites to satisfy the tremendous bandwidth requirements derived from network-centric warfare, while commercial imaging satellites provide imagery to the US National Geospatial-Intelligence Agency for military and intelligence users.[14]

Second, it achieves corporate sponsorship which translates into funding. The space indemnity implications alone may drive commercial participation. The Teal Group made the following observation shortly after China's ASAT test: "About the last thing that the satellite market needs now is the uncertainty that will accompany any moves to start blowing up objects in

space or arming military satellites with protective countermeasures. The added debris problem is bad enough. An ASAT weapons race will have the effect of increasing the financial risk of any satellite program, and this will undoubtedly be felt most within the commercial market through decreased investor confidence and (or) higher insurance rates."[15]

China's space weapons test revealed significant vertical disharmony within the information dimension as well. Space operators got a first glimpse at the dynamic environment in which future space conflicts may unfold. Only strong organizational relationships between the Air Force, Strategic Command, the Defense Intelligence Agency, and the National Reconnaissance Office, along with mature internal and external processes, will ensure the timely flow of critical information during space warfare. The irony of the 11 January test is that it may have strengthened America's space war-fighting posture by revealing the strengths and weaknesses of existing organizational relationships, machine-to-machine interfaces, and system processors. That China's nefarious activities might be considered a net loss, both diplomatically and militarily, serves as an important consideration for future US plans regarding space weaponry.

US efforts to gain transparency regarding China's intentions will benefit from horizontal integration across the other instruments of national power. Increased military engagement, at the operator, staff, and general-officer levels is necessary to build the enduring relationships that can yield greater transparency over time. Diplomatically, the United States must remain engaged, exploring confidence-building measures to (1) further limit the creation of debris in space, (2) establish mechanisms of escalation control, and (3) proliferate well-established norms to new space-faring nations. The decision to suspend plans to develop space ventures with China, including joint exploration of the moon in the aftermath of the ASAT test, only exacerbated the distrust between the two nations and moved the United States further from its goals toward transparency.[16] To this end, it is critical that China's participation in the space alliance is not repressively conditional. Like new weapon systems, new alliances risk the paradoxical consequence of triggering a security dilemma. Restricting membership in the new "space club" will likely create disharmonies that could undermine its utility. The United States must re-

main engaged and earn the trust of other space-faring nations before it can expect to gain significant transparency.

Significant changes to existing export control laws, most notably ITAR, must be part of this new engagement strategy. ITAR has had the self-defeating effect of accelerating the proliferation of space technologies and, indeed, entire industries around the globe. ITAR reforms desperately need political sponsorship. The satellite industry cannot negotiate substantive reforms on its own behalf, and many politicians are far too risk averse to vote for measures that may be perceived as detrimental to national security. Marion Blakely notes that "the ITAR issue has been a minefield for many administrations. Future change won't come from an administration that is politically risk averse. This is a thing you can only do when your political capital is very high."[17] The military, as a stakeholder, has a vested interest in a thriving space industry to procure the systems and capabilities it needs to fight the nation's wars. Military leaders may be the only true, honest brokers to negotiate the changes to the US Munitions List that will allow the space industry greater participation in the global market. To this end, military leaders must encourage lawmakers to work toward a solution that balances the need for secrecy with the need for a competitive industry. The effort must be integrated horizontally, with diplomatic efforts to negotiate enduring legal instruments with close allies such as Britain, Canada, and Australia. The timing is critical, and an opportunity exists within the first year of the Obama administration, ensuring a buffer of time between subsequent election cycles.

Elements of this strategy portend controversy. The United States, for example, must be willing to share what historically has been considered highly sensitive information. The National Reconnaissance Organization prefers to keep the exact location of its collection assets secret since savvy adversaries generally take appropriate countermeasures when collection assets are known to be overhead. The reality is that for years amateur space hobbyists have tracked and published the locations of all of the organization's space-based assets on the Internet.[18] Technologically, the NRO believes it must remain at least one generation ahead of commercial sensors to maintain America's asymmetric advantage in space. ITAR is supposed to prevent

the proliferation of such technologies and thereby negate the possibility that an adversary could employ similar capabilities. However, as markets for "ITAR-free" components continue to mature, it will not be long before foreign counterparts to US-based corporations like DigitalGlobe and GeoEye field sensors with competing technologies. General Shelton notes that "the commercialization of space has allowed many developing nations and non-state actors to acquire space-based capabilities such as imagery and satellite communications that were previously the exclusive purview of superpowers."[19] Culturally, the NRO still prefers to work alone, as evidenced by its decision to invest in a program known as the Broad Area Satellite Imagery Collection. The organization recently lost some decision authority for the program, which some officials believe violates national policies that direct "the military and intelligence community to rely on commercial satellites for general mapping purposes."[20] The existing strategies for space protection, embodied in the cultural biases of organizations like the NRO, no longer have the enduring quality that once made them valid. The trends in the proliferation of space capabilities, both commercially and militarily, suggest it is time to consider a more transparent strategy.

One area that warrants additional research is the US decision not to issue a demarche to China through diplomatic channels in the days and weeks leading to the January launch. Presumably, one debate took place between the intelligence apparatus and other stakeholders over the potential for intelligence collection. Another possibility is that members of the State Department believed a demarche would yield little value, that China would proceed with the test despite US objections, and the United States would emerge diplomatically emasculated. Little is known about the deliberations at the highest levels of the US government, but as information becomes available, an interesting case study in diplomacy will likely emerge.

Luttwak's model encourages planners to seek horizontal and vertical harmony in the strategies they employ. As shown here, the model is also useful in formulating a coherent response to a problem of grand-strategic consequences. US leaders can derive meaningful solution sets by seeking answers to seemingly intractable problems across the vertical and horizontal

domains. Only through the careful integration of all the instruments of national power can America find a way forward in this new era of contested space.

Summary

China's ASAT test on 11 January 2007 was not nearly as "strategically dislocating" as was the subsequent realization that US national security space is ill prepared to meet the attendant challenges of the contested environment—space. Strategies to contain, coerce, or deter China are futile, as Beijing's decision to develop space weapons was one toward greater prestige, relevance, and influence as a major space power. A new paradigm has emerged. The best response for the United States is to prepare for a very different future in space, not with weapons in kind, but with enduring solutions to preserve the utility of space exploitation for all nations. These solutions require a vertically and horizontally integrated effort across all four instruments of national power. Drawing on the inherent soft-power element of space, politicians and diplomats must craft the instruments necessary to form a national security space alliance. The unilateral approach to national security space is a broken promise for the future, and space warriors need to adopt the coalition mind-set that their land, sea, and air counterparts have employed for decades. A multilateral space surveillance fusion center must be their highest priority. All stakeholders should apply a horizontally integrated approach to difficult problems such as export control, transparency, and engagement. Space superiority can be America's destiny, if pursued with the cooperation of like-minded space-faring nations around the world.

Notes

1. Kuhn, *Structure of Scientific Revolution*, 77–91.
2. Mastalir, "China's ASAT Test."
3. Singer, "Senator Criticizes Bush for Tepid Response."
4. Luttwak, *Strategy,* 259.
5. Ibid., 260.
6. Marks, "China's Satellite Navigation Plans."
7. Ibid.

8. Harman, address.

9. In a letter to the Senate Armed Services Committee, the GAO examines the reasons the DOD and DNI have failed to publish a national security space strategy. An excerpt from the letter provides insight:

> DOD and the intelligence community have not developed, agreed upon, or issued a National Security Space Strategy. The National Security Space Office developed a draft strategy in 2004, but it was never issued. The Director of the National Security Space Office and the Director of Space Policy in the Office of the Under Secretary of Defense for Policy provided examples of reasons why a strategy has never been issued. One reason was that the National Security Council requested that the strategy not be issued until the revised National Space Policy was released in October 2006. However, once the policy was released, changes in leadership in the National Reconnaissance Office and the Air Force delayed the issuance of the strategy. In addition, differences of opinion between the defense and intelligence communities over the implementation of the strategy and cultural differences between the two communities further delayed the issuance.

GAO, *Defense Space Activities*, 3.

10. Supreme Headquarters Allied Powers Europe, "Launch of Intelligence Fusion Centre."

11. Peter Hays discusses the benefits of space traffic control in his publication "Military Space Cooperation," 41–42.

12. Joe Rouge presented the neighborhood watch program to an international audience in 2007. Rouge, address, 25–26 October 2007.

13. It is worth noting that NATO once owned and operated its own constellation of military communication satellites to provide immediate satellite communication connectivity between member nations. NATO has since leased transponders on three of its members' nation-owned satellites: the French *Syracuse* series, the Italian *Sicral* constellation, and the UK *Skynet 4* and *5*. "NATO Military Communications Satellite."

14. Commercial imaging satellite operators like DigitalGlobe and GeoEye have multiyear contracts to provide imagery to the US National Geospatial-Intelligence Agency. Clark, "NRO Loses Decision Authority."

15. Cacéres, "Market Impact Brief"; and "Teal Group Assesses Satellite Market Impact."

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Abbreviations

ABM	anti-ballistic missile
AEHF	advanced extremely high frequency
AEP	Architecture Evolution Plan
AFSPC	Air Force Space Command
AMD	Air Mobility Division
ASAT	antisatellite
BA	Bigelow Aerospace
CCP	Chinese Communist Party
CIA	Central Intelligence Agency
CMC	Central Military Commission
CMOS	complementary metal-oxide semiconductor
CMSI	China Maritime Studies Institute
CSAF	US Air Force Chief of Staff
DIA	Defense Intelligence Agency
DIME	diplomatic, informational, military, and economic
DNI	Director of National Intelligence
DOD	Department of Defense
EELV	evolved expandable launch vehicle
ESA	European Space Agency
EU	European Union
GAO	Government Accountability Office
GDP	gross domestic product
GPS	Global Positioning System
IADC	Inter-Agency Space Debris Coordination Committee
ITAR	International Traffic in Arms Regulations
ITU	International Telecommunications Union
JSPOC	Joint Space Operations Center
MFP	major force program
NASA	National Aeronautics and Space Administration
NASIC	National Air and Space Intelligence Center
NATO	North Atlantic Treaty Organization
NORAD	North American Aerospace Defense Command
NRO	National Reconnaissance Office
PLA	People's Liberation Army
PRC	People's Republic of China

RMA	revolution in military affairs
ROE	rule of engagement
SALT	Strategic Arms Limitations Talks
SBIRS	Space-Based Infrared System
SBSS	space-based space surveillance
SDI	Strategic Defense Initiative
SMC	Space and Missile Systems Center
SSA	space situational awareness
SSN	space surveillance network
SSS	shared space surveillance
TAA	technical assistance agreement
UN	United Nations
USECAF	under secretary of the Air Force
USMC	US Marine Corps
USML	United States Munitions List
USSTRATCOM	United States Strategic Command
WGS	Wideband Global Satellite Communications

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